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DISRAELI KOBAK, M.D., Editor

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VOLUME XII, No. 9

SHOULD ELECTRO-MEDICAL EQUIPMENT BE MADE TO MEET A PURPOSE OR A PRICE?

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TEMPERATURE DISTRIBUTION WITH DIFFERENT DIATHERMY ELECTRODES *

ALLAN HEMINGWAY, Ph.D.,
Department of Physiological Chemistry
AND
DEAN COLLINS, Ph.D.,
Department of Physiology
The Medical School, University of Minnesota.

There are two common types of electrodes used in diathermy at the present time. One type is a thin electrode of pliable metal which can be bent or pressed to the part of the body to be treated in order to make a good electrical contact. The other type consists of a thick cotton pad covered on one side with a copper gauze. This is first soaked in some strong electrolyte solution, either sodium chloride or sodium bicarbonate, and then firmly pressed to the body surface where the diathermy treatment is to be given. Bordier[1] has observed apparently greater heating effects from the use of metallic electrodes than from pad electrodes of the same size and with the same diathermy dosage. The following paragraph is taken from his paper:

"If saline pad electrodes are utilized on a patient for diathermy treatment, a large current can be used. For example, a large pad electrode of an area 20x22 square centimeters and, soaked with 10 per cent of sodium chloride was placed on the epigastric region, while a large metallic electrode was placed on the lumbo-sacral region. A current intensity as high as 5,000 milliamperes produced no apparent sensation of heat beneath the moist electrode. After forty minutes no effects of diathermy heating were to be observed. The patient did not perspire, nor was his pulse accelerated. Beneath the electrode the skin was not even reddened. However, on replacing the pad electrode by one of pliable tin, calorific effects were apparent after 7 or 8 minutes even with an intensity of 3,000 milliamperes. After twenty minutes, the sweat ran freely, the pulse became rapid and respiratory movements were accelerated. There is, therefore, between the two methods of technique, a considerable difference in the physiological effects and consequently in the therapeutic effects of diathermy."

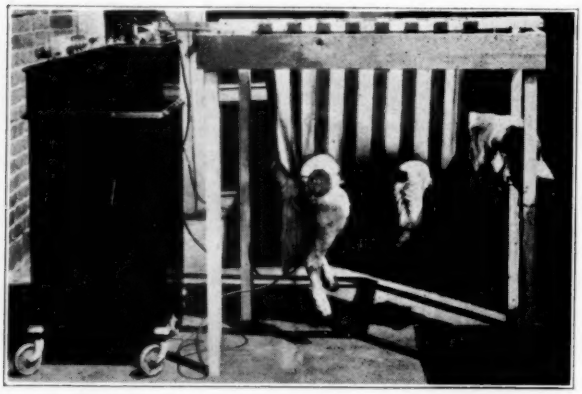
Simon[2] has placed an alcohol thermometer beneath the skin on the front of the thorax and above the fascia of the pectoralis major muscle. A diathermy electrode was placed on the surface of the skin which covered the thermometer bulb. The skin in the region of the electrode and the thermometer was locally anaesthetized with novocaine and adrenalin. A thermometer between the electrode and the skin recorded the surface temperature. Using first a lead electrode of an area 16x10 square centimeters, and a current of 1.3 amperes for 26 minutes, a maximum temperature of 104° Fahrenheit was reached. On replacing the lead electrode by a pad and using a current of 2.0 amperes, in 26 minutes a temperature of 103.6° F. was reached. Thus with less current for the same length of time an increase of .4° F. was obtained with the lead electrode. The surface temperature, however, below the lead electrode, was less than that below the saline electrode in the same experiment.

These experiments of Bordier and Simon indicate that there is a difference in the thermal effects with the different types of electrodes. This being the case we have proceeded to investigate the problem further and to study the temperature distribution in the tissues below the two different types of electrodes with varying values of the current.

Dogs were used as experimental subjects. They were suspended in a hammock consisting of a rectangular sheet of heavy canvas attached by two opposite sides to two corresponding poles whose ends rested on a wooden framework, resembling a table with its top removed. Four holes were cut in the canvas through which the four legs of the dog protruded. The holes for the hind limbs were rather large allowing the whole of the outer surface of the thigh to project outside the canvas.

* Read at the Ninth Annual Meeting of the American Congress of Physical Therapy, St. Louis, Mo., Sept. 10, 1930.

Figure 1



Method of holding dog for diathermy treatment under light anaesthesia.

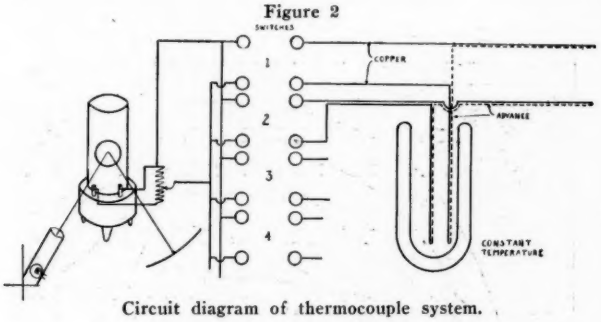
Morphine sulphate, 4 per cent (0.2 to 0.4 cc. per kilo) was injected subcutaneously. Pharmacologists have assured us that this anaesthetic causes a minimum disturbance of the circulation. Sodium luminal injected intravenously was found to give slight temperature variations. Ether with preliminary morphine was found to be entirely unsuitable since it gave rise to erratic fluctuations in temperature, occasioned perhaps by the irregularity of the anaesthetic dose.

For measuring temperature, copper advance thermocouples were used. Seven couples in all were made and connected by double-pole switches with a low resistance moving coil galvanometer which, when placed in a copper shield and critically damped, gave very good results. The general scheme of the circuit is given in Fig. 2 and is similar to that of Clark.[3] As a constant temperature junction, water at room temperature in a well insulated thermos flask was used. The temperature of the water in the flask would remain constant to a hundredth of a degree for several hours but on account of a slight change from day to day was always recalibrated at the conclusion of every experiment. The resistance of the thermocouple circuit was adjusted to give a deflection of approximately 30 millimeters per degree centigrade.

In designing the variable temperature junctions it is necessary to have couples of a low heat capacity which would tend to make thermal disturbances of the tissues due to the introduction of the thermocouples a minimum. Good insulation, except at the junction, is also essential. To meet these requirements thermocouples were constructed which consisted of No. 27 copper wire wound with a single layer of cotton for insulation. Tightly wound in a spiral form around the insulated copper wire was a No. 34 enameled advance wire. Near the junction at the ends of the wires, the insulation was scraped away and the ends soldered. The thermocouple was then covered with a thin layer of collodion which fixed the enameled manganin wire to the cotton insulation of the copper wire. When complete the relatively thick copper wire gave the couple junction good mechanical support and yet is small enough in total diameter to be inserted through the bore of a number 18 hypodermic needle. A section of the variable temperature junction is shown in Figure 3. The constant temperature junction was wound in a similar way and placed in a narrow thin-walled glass tube of the thermos flask.

The outer surface of each thigh of the dog as it projected through the opening in the hammock was first clipped and then shaved. The hair was removed from an area which could be covered by a circular electrode of 10 centimeters diameter in a region over a thick muscular section external to the outer upper part of the femur. At the margin of this shaved space two number 18 hypodermic needles were inserted, directed toward the center of the cleared circular area. One needle ran just below the skin, the other was directed deep into the muscle below the center of the electrode. Needles in the same position were inserted into the surface of the other thigh. A thermocouple junction was now inserted through the bore of each needle. The needle was then carefully drawn out leaving the thermocouple junction in the tis-

Figure 2



Circuit diagram of thermocouple system.

sue. The needle and the junction were both sterilized in 70 per cent alcohol before inserting into the tissue. On one shaved surface was placed an electrode consisting of a thin pliable sheet of the usual lead-tin alloy and of a diameter of 3.5 inches or 8.8 centimeters. On the shaved surface of the other thigh and on the corresponding position a pad electrode of the same size was placed, which had previously been soaked in 10 per cent saline. Between each electrode and the skin and near the center of the electrode a thermocouple was placed to record surface temperature. A seventh thermocouple was placed in the rectum to obtain the general body temperature.

In the experiments of the other workers already mentioned, one electrode was first used which was later removed and replaced by the other. In the method which we use the two types of electrodes are used simultaneously. In this latter case any current fluctuations or any changes in the external conditions such as temperature, air currents, etc., will affect both electrodes to the same degree and will thus reduce the experimental errors where it is desired to study the differences between the actions of the electrodes.

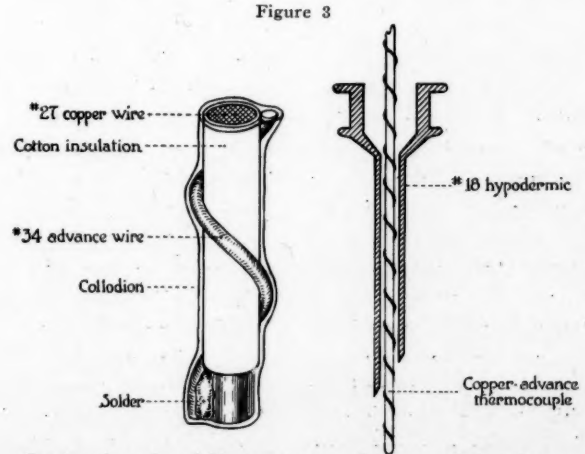
When the electrodes were placed in position, readings of the temperature were taken for 10 to 20 minutes before the current was started, until equilibrium conditions were obtained. The switch of the diathermy machine was then closed and a current of known value passed between the electrodes for one hour. At the end of an hour treatment the electrodes and surface thermocouples were removed while readings of the subcutaneous and intramuscular thermocouples were continued for ten minutes. After the last reading was taken the thermocouples were removed from the dog and immediately calibrated.

Results

The temperature variation in the tissues below the electrodes during the course of a diathermy treatment are given in Figure 4. These are representative of about fifteen to twenty experiments which were made.

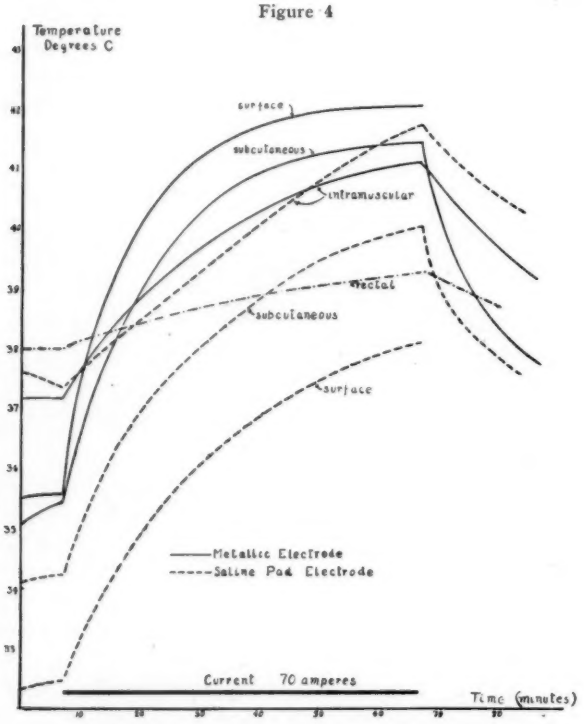
From these curves it is seen that the highest temperature as recorded by the seven thermocouples is usually that recorded by the subcutaneous thermocouple below the metallic

Figure 3



Construction of variable temperature thermocouple junctions.

Figure 4



Variation of temperature beneath circular electrodes 8.8 cms. in diameter during a diathermy treatment.

electrode. The next highest values of the temperature are those of the two intramuscular thermocouples. Usually the intramuscular temperature below the pad at the end of the treatment is somewhat higher. The subcutaneous temperature below the saline pad is in general less than the intramuscular temperatures. The lowest temperature recorded is that of the skin surface below the saline electrode.

Beneath the saline electrode there is a temperature gradient, the lowest temperature occurring at the surface and the highest in the muscle. In other words the tissues become cooler as the saline electrode is approached. This is, of course, considering points beneath the center of the electrode. No exception has been found to this order in any of our curves.

Beneath the metallic electrode, however, a different state of affairs exists. The intramuscular temperature is always less than the subcutaneous temperature and usually less than the surface temperature. The surface temperature between the skin surface and the metallic electrode is extremely variable and may be either the lowest or the highest of the three temperatures which have been measured below the metallic electrode.

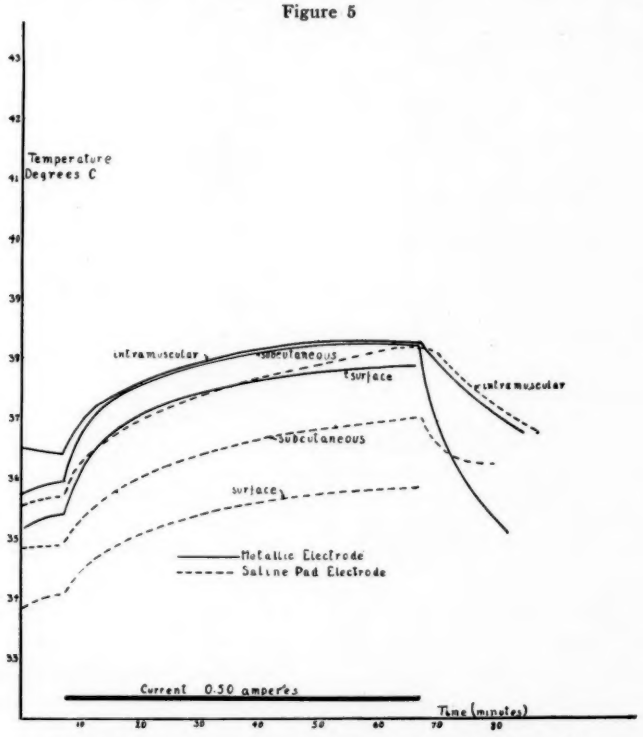
The intramuscular temperatures below the two different electrodes in general are about the same. In certain individual cases one is higher than the other but considering the whole series of experiments the averages of the two will not be far apart.

The subcutaneous temperature below the metallic electrode is in every case considerably greater than the corresponding temperature subcutaneous to the saline electrode.

The surface temperature of the skin in contact with the metallic electrode rises to a much higher value than the corresponding skin surface temperature below the saline pad. Stenstrom and Nurnberger[4] have observed a more rapid rise of surface temperature below a pad electrode but their electrodes were placed over joints where a larger surface heating would be expected to occur with the electrodes used.

A current of 0.70 amperes produces an intramuscular temperature of from 40 to 42 degrees C. during a treatment for an hour. This value is subject to considerable variation due to the fact that there is considerable variation of temperature with the position of the thermocouple junction in the muscle. Such a current will readily produce a burn at the

Figure 5



Variation of temperature beneath circular electrodes 8.8 cms. in diameter during a diathermy treatment.

metallic electrode if a good contact is not made. In two of our experiments cutaneous burns took place with this value of the current, caused by the shifting of the electrode due to restlessness of the dog. When, however, the dog was quiet and good contact was maintained throughout the experiment no burning of the tissues occurred.

A current of 0.70 amperes for one hour produces a subcutaneous temperature of from 41° to 43° centigrade below the metallic electrode. The subcutaneous temperature below the saline pad, which is lower than that below the metallic electrode, varies from 39° to 42° C. but averages between 40° and 41° centigrade.

The surface temperatures below the metallic electrode are extremely variable ranging from 38° to 42°. The surface temperatures below the saline pad vary from 37° to 38° C. after an hour treatment with 0.70 amperes from the electrodes used.

With a current of 0.60 amperes for one hour the temperatures are slightly lower than the averages mentioned for 0.70 amperes.

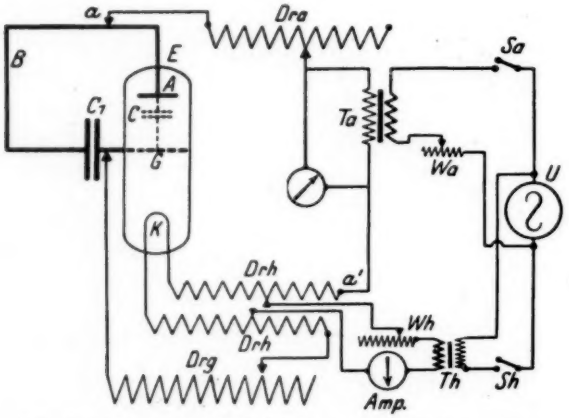
The increase of local temperature only slightly exceeds the general body temperature with a total current of 0.50 amperes or 8.2 milliamperes per square centimeter for an hour. The intramuscular temperatures rise to a value between 38.0° and 38.5°. The subcutaneous temperature below the metallic electrode rises to between 38° and 38.5° C., while the subcutaneous temperature below the pad does not reach 37° C.

Discussion of Results

Our results show that it is possible to raise the muscular and cutaneous temperatures of a dog's thigh to the general body temperature in from 20 to 30 minutes with a current of 8.2 milliamperes per centimeter. To raise the temperature 2 to 5 degrees C. higher, current values must be increased to 10 to 12 milliamperes per square centimeter for an hour's duration.

Our experiments also show that the maximum thermal effects are at different depths from the surface for different electrodes. A metallic electrode causes greater cutaneous than a muscular heating. With the pad electrode, however, a higher increase of temperature occurs in the muscle than in the superficial layers of tissue. Hence for cutaneous heating a metallic electrode is to be preferred, while for increased muscular heating with a

Figure 6



Circuit used by Schliephake to generate high frequency currents of the "short wave" region of frequencies.

low cutaneous temperature increase, a saline pad is desirable.

With the metallic electrode a more rapid rise of temperature takes place during the early part of the diathermy treatment. The temperatures rise more rapidly at first and more rapidly reach their constant equilibrium value than the corresponding temperature below the saline pad. Thus with a diathermy current of a short duration, relatively greater calorific effects would be observed with metallic electrodes than with a treatment lasting a considerable time.

The greater calorific effects of the metallic electrodes, as observed by Bordier, may be explained as being a purely cutaneous effect, the greater cutaneous heat stimulating the cutaneous temperature regulatory processes more strongly.

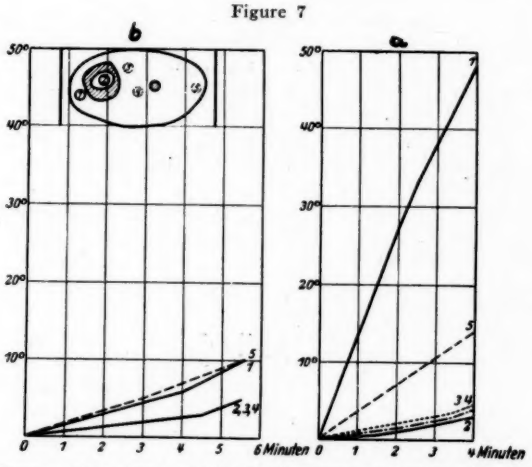
Theoretically, there should be no difference in the total amount of heat produced for the same current by the different electrodes provided the pad contains concentrated salt solution, since Hemingway[5] has shown that the difference between the high frequency electrical resistances with the different types of electrodes is inappreciable. There is, however, the observed difference in heat distribution.

It is of interest to compare the results which we have obtained with those of Schleiphake.[6] He has used for a device for increasing the temperature a high frequency electrical field of a frequency range which is known in radio-engineering as the short-wave region and includes frequencies from 10^7 to 10^8 cycles per second. The use of such frequencies in diathermy will be referred to here as "short-wave diathermy."

A diagram of the circuit used by Schliephake is given in Figure 6. The subject to be heated is placed between the plates of a condenser in a circuit which is completely separated but inductively coupled to the main oscillating circuit. This secondary circuit is then tuned to the frequency of the main oscillator by varying the capacity or inductance of the receiving circuit. Such circuits have been extensively used in this country for studying the heat effects on lower organisms but little work has been done on their therapeutic application.

In Figure 7 which was taken from Schliephake's paper, a section of an amputated leg has been heated with the usual diathermy and later with short wave diathermy. On the ordinates are given the temperature increases while on the abscissae are recorded the time from the commencement of the current. The numbers on the curves correspond to the thermometers which were placed in the skin, muscle and bone as shown in the cross-section. It is to be observed that with short wave diathermy a much greater deep temperature can be obtained with a given skin temperature than with the usual diathermy, such as we have used in our experiments. Schliephake's curves indicate that there are important therapeutic possibilities in short-wave diathermy but at present the experimental difficulties as to the dosage measurement and regulation are extremely difficult and have not as yet been satisfactorily solved.

Figure 7



Curves taken from Schliephake's paper comparing the rise of temperature of different sections of an amputated leg (a) during a treatment with the usual diathermy machine, (b) during a treatment with "short wave" diathermy.

Acknowledgment

We wish to acknowledge the interest shown by Dr. W. K. Stenstrom of the Department of Biophysics for his interest in this problem and to thank him for many useful suggestions. We are also very grateful to the Victor X-Ray Company for the loan of a diathermy machine with which these experiments were performed.

References

(1) Bordier: Sur la chaleur degazee par la d arsonvalisation diathermique au moyen d'electrodes spongieux; graves inconvenients de as electrodes. *Competes Rendus,* **186:**540 (1928).

(2) Simon, G.: Relative Efficiency of Pads Moistened with Saline Solution and Lead Plates as Electrodes with Diathermy Current. *Brit. Jour. Rad.,* **2:**242 (1929).

(3) Clark, H.: The Measurement of Intravenous Temperatures. *J. Exptl. Med.,* **35:**385 (1922).

(4) Stenstrom, W., and Nurnberger, Paul: Effects of Diathermy Treatments on Temperature. *Arch. Int. Med.,* **44:**556 (1929).

(5) Hemingway, A.: Thermal Effects of Diathermy. *Radiology,* **14:**99 (1930).

(6) Schliephake, Irwin: Tiefen wirkungen im organismus durch kenze elektrische Wellen. *Z. f. d. ges. Exper. Med.,* **66:**212 (1929).

Discussion

Dr. Norman E. Titus (New York City, N. Y.): It is really very interesting to see how many of our ideas regarding the deep heating action of diathermy is being demonstrated by independent workers and disproving the contentions of those that denied this possibility. Dr. Hemingway's report is a valuable contribution to the usefulness of diathermy as a means of deep heat production for it shows us conclusively that it is possible to raise the temperature of the deeper structures. I have two thoughts to bring to his attention. Very frequently in hospitals we find people with hysterical anesthesia. I have always wondered why somebody who had the equipment and time didn't make use of one of these people who couldn't feel pain or temperature and still had good circulating blood going through the part. It appeals to me that these are the ideal types to conduct experiments, either with a view to curing them or advancing science.

I think if you didn't go in too far with the needle, you could arrange some thermocouples into a limb that was anesthetic, and determine what happens in a living human being. I have several patients in New York that I should like to send out to you for experimentation purposes. Of course, at the end you could shoot a little galvanic electricity through the needle and convince them it was over.

Another point I want to mention is in reference to the new German short wave diathermy mentioned by the doctor. I certainly hope that he will not force that name into the literature, because diathermy, as we understand it, is heating through from one electrode to the other, whereas the heat formed when there is air between the skin and the electrodes, as in this short wave radio high-frequency treatment, is heat that is set up by eddy currents, by dielectric loss in the tissues. It is a much more complicated thing than ordinary diathermy for the young doctor in high-frequency work to understand. It is a little bit deep. If a salesman got hold of that and began to talk that to the doctors, the doctors would throw up their hands and say, "I don't know where I am. I did think I knew something about diathermy."

That work has been carried on a great deal, as Dr. Hemingway knows, in this country, and there are machines now being used on human beings extensively. We had one sent by the General Electric to the state psychiatric hospital. There they are doing some work on treating general paretics to raise the whole body temperature. They figure they can raise the temperature pretty well on them because they belong to the state. They were frankly afraid to try it out in the Albany Hospital and in Schenectady where the work was under the direction of Dr.

Whitney. There they were afraid to raise the temperature over 102 degrees.

They have large plates about a meter in diameter. The patient is put between those into the electrostatic field. The circuit has an oscillating frequency of 10,000,000 to 15,000,000. They have been able to raise the body temperature slightly, but they have been afraid they might be used, because sometimes the perspiration gets too hot and blisters the patients, even though they are covered with Turkish towels and blankets. Now they are able to work on subjects that belong to the state. As long as Tammany Hall runs it, we might be able to get some results on those patients. Perhaps in a year there will be something worth while done in the treatment of paresis with the short frequency waves.

I hope we can find a name for treatment with this form of current that isn't diathermy. You may argue and say that it is diathermy. In fact, I would say it is truly endothermy. It is heat created within, but it is not heat passing through, which diathermy is.

With this new form of machine, the literature is likely to be complicated some more, and those of us who are interested in terminology will have our battles on with renewed vigor. Perhaps some word can be gotten up to describe it that will not make it too ultra-scientific and awe-inspiring to the doctor who delves into high-frequency electricity for the first time.

Dr. Luther A. Tarbell (New Haven, Conn.): I was very much interested in this paper because I have done some experimental work along similar lines. I had a patient who learned to swallow a thermocouple tube or take it out on direction. On this particular patient I put the wire of my thermocouple in a small rubber tube and placed it in the stomach. Then I placed the patient over the fluoroscope with some barium sulphate, in order to actually outline the stomach. I then fixed anterioposterior electrodes over the region of the stomach, trying to center the heat as much as possible over the stomach, following some work of Bordier in France, who had attempted a similar experiment. I really copied by ideas from him. He was able to increase the temperature in the stomach by that means, 1.6 degrees. By the same method, using a higher powered instrument than Bordier used, I was able to get an increase of 2.68 degrees, measured by the galvanometer, in the stomach.

This work was not as accurate as that performed by Hemingway, because our control was in a glass which was outside the field, and the other one was in the stomach. There is a chance there, of course, for errors which we could not compute as easily as he could, having both within the field.

I tried some of the other currents, that is induced endothermy, if you want to call it that, produced by inductive current where there was no contact. I tried it on a guinea pig which I had within the field of that current. Without apparently being able to produce any discomfort on the part of the guinea pig, any unusual discomfort, as he had to be held, of course, I was able to increase his general temperature, measured by a thermometer placed subcutaneously under the skin. I got a rise in that case of 1.2 degrees.

I think that particular field has great possibilities. The work of comparing the two electrodes has been particularly interesting to me. While I have not made accurate observations clinically, it has been my observation that in a great many treatments, particularly using large electrodes, the metal electrodes have been more efficient. It is my impression that if you use higher milliamperage, you will find that you will get a still greater heat increase internally from the metal electrodes, that is if you go up beyond the milliamperage he used of about 11 per square centimeter. If you were to carry that up to 20 or sometimes a little more, using an electrode paste, that is some kind of thick paste with an electrolytic in it, salts, zinc, copper or some other element, it would greatly add to the efficiency of penetration.

Dr. Albert Bachem (Chicago, Ill.): I should like to ask Dr. Hemingway whether he has an explanation for the pronounced difference that he found with the metallic and with the saline electrodes.

A year ago when I reported measurements that I had made with galvanic, alternating and high frequency currents, I found a great difference in whether the skin was dry or wet for the galvanic and alternating currents. For high frequency currents I couldn't find much, or practically any difference, provided there was good contact, even in the case of dry skin.

I want to know whether Dr. Hemingway has an explanation for this fact. As far as this work is concerned in which the tissue is not in contact with the electrodes, I would say that as physicists we wouldn't have much difficulty; we would simply distinguish between closed or open currents or between currents and waves. Altogether, I don't see much difference in whether we have the current closed or not. I would rather stay out of the whole discussion of whether we call it diathermy or anything else. I would rather have the medical faculties start a war along that line.

Dr. Titus: We might speak of it as inductothermy.

Dr. Allen Hemingway (Minneapolis, Minn.): I should like to thank the doctors who have discussed this paper for their very favorable discussion.

In answer to Dr. Titus I should like to obtain some of those patients in whom we could place the thermocouples. I think there are possibilities in that type of experiment because we have been using sterilized thermocouples, and the dogs show absolutely no skin markings several days after the experiment. We use a very light anesthesia. Placing these thermocouples into their muscle does not seem to hurt them very much, and they show no ill effects after several days.

As regards the terminology, I simply followed

the terminology of the electrical engineers in calling this short-wave diathermy. Of course, the term diathermy does not belong to the electrical engineers. I suggest that the Council of Physical Therapy could perhaps decide on the proper terminology for the higher frequency currents.

The experiments mentioned by Dr. Tarbell are very interesting, in respect to the deeper temperatures. I think any experiments where the temperatures of the deep tissue, for example, in the stomach, have been measured, are very important clinically.

In this work with dogs there is the old question that can be raised, and that is can the experiments on dogs be applied to a clinic? I think experiments on human beings in that respect are very important.

The question of some method of contact between the metallic electrode and the skin I have never tried. I think in that way there would be a sort of combination between the pad electrode and the metallic electrode, and that would remedy any ill effects of the metallic electrode. I think there are good possibilities in that.

In reply to Dr. Bachem in explanation of these differences, I have not as yet tried to determine what causes those differences, but I believe they are due to evaporation of moisture from the skin or from the saline pad electrode. That is one possibility. I do not say it is the only one.

Diathermy as an Aid to Diagnosis

Julian Arendt, in a report on intravenous media for visualization of the gall-bladder and urinary tract (*Roentgenpraxis*, Dec. 15, 1930, ii, p. 1147), suggests that diathermy, applied to the gall-bladder region for fifteen or twenty minutes after intravenous injection of tetraiodophenolphthalein, will produce a good shadow contrast in three or four hours. The usual time required for satisfactory visualization is from twelve to fifteen hours. A similar technic applied to the kidney region will hasten and intensify the absorption and excretion of uroselectan for studies of the urinary tract. The author suggests that the effects noted are probably due to an increase in the circulation of blood and lymph in the structures, produced locally by the heat. The use of diathermy in this connection does not vitiate the diagnostic value of the tests in any way.—*M. H. P. T. and E. S.* **50:**345 (Aug.) 1931.

SOME IMPORTANT PHASES OF ROENTGENOGRAPHIC DIAGNOSIS IN CHEST DISEASES *

J. J. SINGER, M.D.

ST. LOUIS

Washington University School of Medicine

The roentgen ray in particular and clinical methods in general now make it possible for us to delve into the inner recesses of the lungs. We are more fortunate than our predecessors since the methods at our disposal permit us not only to visualize but also to diagnose deviations from the normal previously unappreciated.

In the interpretation of the roentgen ray film it must always be borne in mind that we are dealing with superimposed shadows. In other words, if the film is taken in such a way as to place the positive shadow, that is, the lesion, away from, rather than close to the film, then the result will be a large irregular shadow in which the lesion will be lost. It can therefore be seen at a glance that a preliminary fluoroscopic examination can be most helpful, for it will indicate the most desirable position in which the film should be taken.

The intensity of the roentgen rays as they leave the target and the time element are also important considerations.

It should be our aim to attempt the correlation of the information obtained on physical examination with the roentgen ray findings.

Fluoroscopy, as already mentioned, is most helpful. It allows us to obtain information concerning the movements of the heart, diaphragm, the changes effected by respiration and position. Cognizance must be taken of them all, not only because they influence one another but because they may be either the cause or effect of some pulmonary process.

The following methods to which brief reference has been made illustrate how it is possible to further clarify what at first glance appears to be a more or less homogeneous roentgen ray shadow.

Bronchography: There are seven ways of introducing iodized oil into the lung. The simplest is the aspiration method which only requires that the patient take deep breaths while the iodized oil is dropped over the base of the tongue. This method can be performed without the use of a local anesthetic.

Diagnostic Pneumothorax: Diagnostic pneumothorax, the introduction of air into the pleural cavity, not infrequently proves of value, particularly in the differentiation of extra- and intra-pulmonary masses.

Fluid withdrawn from the pleural cavity should be replaced by air in small amounts. A fluid level is thus created and by altering the patient's position it is now possible to outline the size and shape of the pleural fluid pocket in its entirety. The air can be injected with an ordinary syringe and need not be filtered, for Jacobaeus has frequently pointed out that from his experiences with thoracoscopy the entrance of ordinary air into the pleural cavity in small amounts does no harm. However, in our pneumothorax work we use ordinary air which is filtered through some absorbent cotton.

Postural Drainage: Bronchi and cavities which are filled and obstructed with purulent secretions not only influence sound waves but also the roentgen ray film. For this reason postural drainage frequently used for therapeutic purposes may prove most valuable if employed preliminary to the physical examination and the taking of a roentgen ray film. Postural drainage can be carried out on a specially constructed tilting table or by merely having the patient lean over the edge of the bed or over a chair. It is often advisable to fluroscope a patient on a tilting table for one can then more readily alter his position and thus bring hidden shadows to the fore.

Conclusions

1. The roentgen ray constitutes an indispensable aid in the diagnosis of diseases of the chest.

2. Bronchography, diagnostic pneumothorax and postural drainage are all valuable adjuncts and contribute in no small way to the

* Read at the Ninth Annual Meeting of the American Congress of Physical Therapy, September 8, 1930, St. Louis, Mo.

making of an accurate roentgen ray diagnosis.

3. Roentgen ray methods have increased and will continue to increase our diagnostic acumen only if combined with the clinical history and physical findings.

Medical and Surgical Chest Service,
Barnes Hospital.

ACTINOTHERAPY IN RELATION TO TUBERCULOSIS *

GEORGE D. KETTELCAMP, M.D.

Koch Hospital

KOCH, MO.

Within the last decade actinotherapy for certain forms of tuberculosis has become definitely established. Our ancestors many centuries ago recognized the need of sunlight for the proper function of living organisms. Hypocrates, Herodatus and other ancients recommended taking sunbaths. Our technic of exposure at Koch Hospital follows more or less closely that used by Rollier, our great contemporary exponent of heliotherapy.

Light rays, as you know, are classed according to the length of the wave, and the unit ordinarily used is the Angström unit, which is one ten-millionth part of a millimeter. The rays to which we shall refer extend in the therapeutic spectrum from the infrared to the ultraviolet. This is approximately between 20,000 Angström units and 1850 Angström units; 3900 Angström units marks the last visible violet, and the ultraviolet here considered lies, principally, between this and 1850 Angström units. A more detailed explanation of this technical phase can be found elsewhere. A very instructive and comprehensive thesis on the basic principles and theories was recently written by Dr. Goldberg[1] and published in the January, February and March, 1930, *Bulletin of the Chicago Municipal Tuberculosis Sanatorium.* Suffice it to say here that the heat (or so-called "physical") rays are found in greater quantity on the red side of the visible spectrum and back into the infrared zone, while the chemical rays are found in the violet end of the visible spectrum and over into the ultraviolet zone. The proportion of these physical and chemical rays varies with various types of lights and even with sunlight under varying conditions.

Our experience at Robert Koch Hospital has been with four methods of applying the therapeutic ray, namely:

(1) Exposure to the sun's rays.
(2) The air-cooled mercury arc in quartz.
(3) Water-cooled mercury arc in quartz.
(4) Carbon arc lamp.

Sunlight

Sunlight contains all the rays of the visible spectrum, ultraviolet rays and a great amount of heat rays. We have found sunlight very beneficial in certain types of cases, especially tuberculosis of the glands, bones, and peritoneum. These patients usually possess a less active type of tuberculous diseases and are less toxic. They are more resistant to the heat rays and we think this explains why we have had many good results and very few unfavorable results with this type of case under solar light therapy. However, even the most resistant must be exposed slowly and gradually until they become accustomed to the rays. As stated before, our method of exposure has followed, very closely, that of Rollier. To accustom the patient to the sunlight the body is exposed in zones, as follows:

In the first treatment ZONE 1, namely feet to ankles, is exposed 5 minutes.

In the second treatment the feet to ankles is exposed 10 minutes, and ZONE II—ankles to knees—is exposed 5 minutes.

In the third treatment feet to ankles is exposed 15 minutes, ankles to knees 10 minutes, and the ZONE III—knees to hips—is exposed 5 minutes.

In the fourth treatment feet to ankles is exposed 20 minutes, ankles to knees 15 min-

* Read at the Ninth Annual Meeting of the American Congress of Physical Therapy, September 8, 1930, St. Louis, Mo.

utes, knees to hips 10 minutes, and the ZONE IV—hips to chest—is exposed 5 minutes.

In the fifth treatment feet to ankles is exposed 25 minutes, ankles to knees 20 minutes, knees to hips 15 minutes, hips to chest 10 minutes, and ZONE V—namely, chest to neck—is exposed 5 minutes.

The head should not be exposed to the direct rays of the sun.

In some cases the treatments as outlined above are given once daily and in some others two times daily, depending on the individual's reaction. In this way the patient becomes gradually accustomed to the light rays and can be exposed for several hours daily without harm to health. As suggested above, the heat from the sun is the dangerous element and, consequently, we must avoid the mid-day sun. That solar therapy can react unfavorably was brought home to us in the summer of 1927. Then we were not equipped with the ultra-violet lamps and, feeling that we should do something for our many cases of enteric tuberculosis, we started a routine of exposing them to the sun with chests covered. Of course, some cases on account of moribund conditions or other contra-indications, were not exposed. At our staff conferences it became evident that our results were not sufficiently good to warrant this procedure. Many patients reacted unfavorably. The time of exposure was decreased in many instances and in many other instances the treatment was discontinued entirely. I would not leave the impression that none fared well. There were some—relatively few—who fared very well. We have four or five patients whose improvement was nothing short of marvelous. These patients who had been with us for years, steadily declining with far advanced pulmonary tuberculosis and subsequent development of enteric lesions with marked anorexia, loss of weight, low grade temperatures, tenderness over the abdomen and in some cases diarrhoea, gained many pounds in weight, lost their tenderness, regained their appetites and are now either discharged as arrested or are on several hours exercise daily. We believe it was primarily the heat rays that caused the unfavorable reactions in so many of our cases. These favorable cases, though they had a far-advanced pulmonary tuberculosis, had augmented their resistance by their many years of fighting and were not highly active cases. Because of this low-grade activity they were able to withstand the heat rays and received marked benefit from the treatment.

With gland and bone cases benefit was the rule, and harmful effects seldom, if ever, noted. These cases usually had slight pulmonary lesions and from the standpoint of temperature and other toxic manifestations, a very low-grade activity.

J. M. is a colored man who had a tuberculous hip and ankle with many sinuses. These healed completely. He became negative to 10 mg. of tuberculin subcutaneously administered, and was discharged about a year ago as an arrested case.

V. K., a girl five years old, certainly was a picture comparable to the worst of Rollier's illustrations. She had a tuberculous hip with ten sinuses opening at various points about the back and pelvic girdle. She was very weak, emaciated and anaemic and appeared to be a hopeless case. After two seasons of solar therapy all the sinuses closed, her weight is normal, she is up and very active. She has been operated on to relieve the contractures and at present has only a slight limp.

R. H., a white female 58 years old: Entered Koch Hospital December 28, 1925, with caseous pneumonia in the upper right lobe and infiltrations in left lung above fourth rib. The upper right lobe finally was completely excavated. Patient continued very ill and eventually developed an enteric tuberculosis. In September, 1926, the gastro-intestinal x-ray was positive. Heliotherapy was started in April, 1927. Patient had been a complete bed patient much of the time prior to this. Never had more exercise than toilet room privileges. She had been constantly losing weight and at this time weighed 91 pounds. At approximately the same time heliotherapy was begun a rather acute abscess developed in the left vulva which was incised. A draining sinus existed for many months before the wound closed. For ten months after heliotherapy was begun her exercise was not increased beyond toilet room privileges, but there was relief from symptoms and gain in weight. This improvement was continuous and at present the patient is exercising about five hours daily, is free from gastro-intestinal symptoms and weighs 145 lbs., a gain of 54 lbs. There is a very marked fibrosis and healing of the pulmonary lesions.

Air-Cooled Mercury Arc in Quartz

The air-cooled mercury arc in quartz offers much more of ultraviolet rays and much

less of the heat rays than does the sun. At Robert Koch Hospital we have three solaria for treatments with these lamps. Two of the solaria have two lamps each, and are used for adult patients. One has only one lamp, and is used for children. These lamps are suspended from the ceiling 72 inches above the patients, as they lie on their cots. Four adult patients can be exposed at one time in each of the two-lamp solaria and, unless the children are too large, four can be exposed at one time in the one lamp solarium. In the case of our two large solaria the nurse and the controls are outside the room, and the nurse is able to watch her patients through a closed glass window. While taking the treatment the patients must always protect their eyes from the rays. They must be gradually accustomed to the light rays. This can be accomplished in various ways. As most of our patients treated by these lamps are cases of enteric tuberculosis I shall describe our management of these patients. However our method is by no means arbitrary and other ways are probably as good.

It is our custom to cover the chests while exposing them to the lights. Whether or not this is necessary is debatable. Our schedule is as follows:

First Day: Expose abdomen and arms 5 minutes.

Second Day: Expose abdomen and arms and corresponding area of the back each five minutes.

Third Day: Same as second day, plus 2 additional minutes to the area from the chest to the knees, both anteriorly and posteriorly.

Fourth Day: Same as third day, plus 2 additional minutes to the area between chest and feet, both anteriorly and posteriorly.

Fifth Day: Same as fourth day, plus 2 additional minutes to the entire body except chest, anteriorly and posteriorly.

After this, the time must be increased gradually and according to the patient's reactions. Our maximum has been 30 minutes anteriorly and 30 minutes posteriorly. If unusual symptoms appear such as nausea, rising temperature, headaches, or weakness, the time is decreased or the patient may even be allowed a few days' rest without exposure. As stated above, we believe the danger of doing harm with the quartz lamp is less than exposure to the sun because of the heat element in the sun's rays. Two cases showed skin sensitization to the rays. One gradually overcame this, the other did not. The number of cases that we think might have been unfavorably influenced by the lamps are very few. The majority are greatly benefited. Such symptoms as nausea, vomiting and abdominal discomfort are often very much improved after a few treatments. Several patients who suffered amenorrhoea for many months started menstruating after two or three months' treatment. Patients with dysmenorrhoea for years were markedly relieved by lamp treatments. One case of enteric tuberculosis who had improved much under solar therapy did not obtain relief from her dysmenorrhoea until she had been given lamp treatments. One patient who had been a nurse in training and who had suffered severe headaches at the menstrual time was relieved after taking several months of lamp treatment. She had had tuberculosis of the tubes, ovaries and peritoneum with a large postoperative abdominal sinus. Except for the periodic headaches she recovered completely under solar therapy. After serving several months as assistant to our nurse in charge of light treatments she re-entered the training school about a year ago and needs at present only about six more months to finish her course in training.

The most definite results, however, are noted in the patient's nutrition. Patients with anorexia frequently develop a very good appetite and ability to digest and assimilate their food.

> E. K., another nurse in training, entered Koch Hospital, November 25, 1925, as a moderately advanced class A with involvement mostly limited to one lung. There was for a time some suspicion of malignancy as the lesion spread from the hilus and a very diligent search failed to reveal tubercle bacilli in the sputum. After several months of routine treatment her sputum had become positive and she had retrogressed to far advanced class B. A pneumothorax was done with excellent collapse. Patient improved for a time then began to retrogress again. There was slight fever, loss of weight, marked anorexia, gastric distress, abdominal tenderness. X-ray corroborated the diagnosis of enteric tuberculosis. Except for toilet room privileges she was a complete bed patient. She weighed 114 pounds when treatments with the air-cooled mercury quartz lamp were started. In three weeks her weight increased to 123 pounds, appetite was much im-

proved, gastro-intestinal symptoms much relieved. In four months she had reached 130 pounds, which is practically her normal weight. Her symptoms disappeared. Her x-ray became negative for enteric tuberculosis. About one year ago, eighteen months after light therapy was begun, she was appointed assistant to the nurse in charge of light treatments, which position she still holds. (The position vacated by the nurse mentioned above.) Within the last year her lung has been allowed to expand, she retains her normal weight and remains symptom free to the present time.

G. C. was a very toxic case with a basal tuberculosis limited to one lung. It was collapsed at once. After two weeks she developed a spontaneous pneumothorax from which she escaped death by a very small margin. Repeated air aspirations were necessary. Then came the usual tuberculous empyema. Temperature gradually receded but the patient remained very weak and emaciated and developed severe gastro-intestinal symptoms, especially anorexia and tenderness. X-ray corroborated the diagnosis of enteric tuberculosis. The treatment with the air-cooled mercury arc lamp was begun with patient weighing 103 pounds. In five months she reached her normal weight of 149 pounds and continued gaining until she reached 165 pounds. Her weight has remained above normal although she again dropped some below 165 pounds. She is practically symptom-free, although she still has the empyema. However, the pus forms much more slowly and, whereas it formerly was loaded with tubercle bacilli, it now is microscopically negative for tubercle bacilli. She is now on four hours exercise daily. This patient gained 29 pounds within two months after lamp treatments were begun.

W. B. was a far-advanced class C with very extensive cavitation on admission to the hospital and developed enteric tuberculosis while in the hospital. This was an unusually severe case having eight to ten bloody stools daily. Patient was almost moribund. He was given the treatment with mercury quartz lamp and within a week his temperature and the bowel condition improved markedly. Seven months after his first exposure he had gained 20 pounds, was on some exercise, on regular diet, had no gastro-intestinal symptoms, and no pain on physical examination. His pulmonary tuberculosis progressed. Light treatments were later discontinued temporarily because of hemoptysis. He also developed tuberculous laryngitis before he died, on March 3, 1930. This patient's gastro-intestinal symptoms disappeared about five months after light treatments were started and he was free from them for sixteen months, or until three months before his death.

Many other favorable cases could be cited did time permit, some with results just as favorable as those mentioned and others with very favorable results.

Water-Cooled Mercury Arc in Quartz

Our experience with the water-cooled mercury arc lamp is less extensive. This lamp has been in use a shorter time. We have treated tuberculous laryngitis with, at least, relief from symptoms. While we do not feel that we have had any cures of tuberculous laryngitis as a direct result of this treatment, the relief which it affords these unfortunate patients is well worth the effort. One of our resident physicians in charge of the sickest group of patients at the institution remarked to me recently that the discouraging spectacle of laryngitis patients who are so uncomfortable that they cannot eat, has become quite uncommon since we have been using the ultraviolet radiations to the larynx. This lamp is very potent and we seldom expose a larynx longer than one minute.

One patient had a large swelling on the side of his face which we were unable to diagnose definitely. It was in the region of the parotid gland, and there being some question about fluctuation, a needle was inserted but no fluid found. The patient was then given treatments locally with the water-cooled mercury arc lamp and the swelling which had existed for months, disappeared very promptly. It is possible that the puncture may have been a factor in stimulating absorption.

We have seen cases of very chronic ulcers of the soft tissues of the arm in tuberculous children heal up quickly with this form of treatment. We had one case of a very intractable, long-standing ischeo-rectal sinus which derived marked benefit from treatment with this lamp.

Carbon Arc Lamp

The quality of light emitted by the carbon arc lamp varies with the types of carbons used. This difference in carbons is accomplished by incorporating different mineral substances into them. In the type of lamp we use, at least nine different carbons are available; for example:

Carbon "A" is said to emanate light which

is weak on the ultraviolet end of the spectrum and strong on the infrared.

Carbon "C" is designed to produce a maximum of ultraviolet rays.

We use Carbon "B" which is designed to produce a quality of rays similar to those produced by the mercury arc lamp.

We are now using one portable carbon arc lamp. We used two for about two years but when a replacement became necessary it was replaced with a portable mercury arc lamp. We have not used this mercury arc lamp long enough to prove its superiority over the carbon but from our short experience with it and also from the results from the mercury arc in the solaria I am led to believe that in enteritis cases the mercury arc is more effective. It must be remembered, however, that the portable lamp is used on the sickest and most toxic patients whom we would not move to the solaria and it is unfair to make a comparison between results obtained in the solaria with the mercury arc lamp, and at the bedside with the carbon lamp.

While there are really no cures attributable to the portable carbon lamps because when patients become strong enough to be moved to the solaria they are sent there; still, the relief from suffering which it affords especially to patients with tuberculous enteritis is very great. Although most of these unfortunates do not recover, the final months of their existance is made much less uncomfortable. If for some reason—such as hemorrhage—the light application must be discontinued, the patients frequently ask that the light be applied again to relieve them of the gastro-intestinal symptoms and abdominal distress.

In appraising the value of any therapeutic agent cures do not tell the whole story. Any agent that will reduce the discomfort in that one great battle which eventually we all lose is much to be desired. There is no doubt that the portable lamps—be they carbon or mercury arc— do accomplish this in many of the cases of terminal enteritis and occasionally start an improvement which continues as the patient is transferred to the solarium for further treatment.

In the preceding pages of this paper I have given you some instances of very striking results from light therapy. I would not leave the impression that the percentage of cures is as encouraging as the results in certain cases.

The following table lists five of the many conditions treated with artificial light therapy during the past 29 months. Some of these patients also received some heliotherapy during this time. None of them here listed received the artificial light less than two months most of them much more.

Diagnosis	Cases	Disch. as Arrest.	Im-prov.	Stat.	Retro.	Disch. As. Advice	Dead
Enteritis	121	2	28	16	15	5	55
Enteritis Susp.	63	4	9	4	36	0	10
Epididymitis	10	0	5	1	2	0	2
Laryngitis	22	2	2	0	4	2*	12
Peritonitis	6	4	2	0	0	0	0

* One of these patients transferred to City Sanitarium, mental case. In 7 whose x-ray was formerly positive for enteric lesions it has now become negative.

It will be noted that the mortality and morbidity rate in most instances is still high; but, when we remember that until the advent of light therapy pulmonary tuberculosis complicated by tuberculous enteritis or tuberculous laryngitis was considered almost hopeless, the figures show that light therapy has a life-saving value in these cases. In the cases of peritonitis it is more evident. This with its other effect which is so hard to measure and yet so evident to one dealing with these cases, namely, its ability to alleviate the distressing symptoms, especially of enteritis and laryngitis, indicates what an important place this form of treatment holds in tuberculosis.

Reference

1. Heliotherapy. *Bulletin Chicago Municipal Tuberculosis Sanitarium,* January-February-March, 1930.

THE DIAGNOSIS AND TREATMENT OF INTESTINAL TUBERCULOSIS *†

S. H. WATSON, M.D. AND R. J. CALLANDER, M.D.
TUCSON, ARIZONA

Intestinal Tuberculosis means the organic involvement of some portion of the intestinal tract with a tuberculous lesion and usually implies the breaking down into ulceration. Easily the most frequent site is the caecum or proximal portion of the colon and the terminal ileum or most distal part of the small bowel. Of course, in the extensive and advanced cases, almost the entire colon is involved. Recent studies have shown that involvement of portions of the upper small bowel are not as uncommon as has been supposed. The duodenum is apparently more often involved than the rest of the upper portion of the small intestine. Probably many of our duodenal ulcerations that apparently offer the most resistance to treatment on the best of ulcer management are of this type. The stomach is very seldom attacked. *The diagnosis* occasionally may be quite simple and easy, and at other times so difficult as to be practically impossible.

Intestinal Tuberculosis is usually found in the far-advanced pulmonary case—that is, the case with cavitation—and most frequently in the case that has become quite chronic. This is so true that we consider every such case to potentially have intestinal tuberculosis. There is one rare type of lesion in the caecum — the infiltrative type — which may as frequently be found in other types of pulmonary involvement. However, this type is so rare that it is not usually confusing. It is probably the only type that might be successfully treated by surgical management. Furthermore, it is the only type that in the x-ray examination gives filling defects of any size.

Relative to *symptomatology,* pain is usually present and most often severe. At times it is continually present, while at others it is occasionally intermittent. The same may be said to be true of *fever.* Frequently it is extremely difficult to determine whether a given fever originates in the lungs or in the intestines. *Gas* is also a rather constant symptom. With an occasional case it is almost the only symptom and appears to be entirely resistant to the usual measures of handling this symptom in bowel conditions. *Diarrhoea* is a very important symptom and rarely absent. In the early cases it alternates with constipation—the diarrhoea usually lasting longer than the latter. In the advanced cases it is persistant and very marked, often eight to thirteen or more stools a day. When *constipation* is marked the involvement is likely to be limited to the ileum. *Gastroic symptoms* such as nausea or vomiting may occasionally predominate the picture. The stool examination is of little value. The presence of tubercle bacilli is of no significance since they can be due from swallowed sputum. The presence of pus is likewise of relatively little value, but the finding of blood (gross or occult) is, of course, of high significance, especially in association of a meat-free diet.

Contrary to the belief of many, hemorrhage is not frequent, but does occur occasionally. Also a search for amebae or other infestations is helpful in the different diagnosis. Proctoscopic examination is important only when negative, except in rare cases.

The x-ray examination is the most important diagnostic procedure and without it, it is practically impossible to make a definite diagnosis. In the main, we are indebted, to Brown and Sampson[1] of Saranac, for this invaluable proof. In our work, their technique is closely followed, although we attempt in a great many cases to do a complete gastro-intestinal x-ray examination. However, in all cases in which we suspect intestinal tuberculosis the six, seven, eight and twenty-four hour films are exposed, and occasionally others if so indicated. We are not of the same opinion as some that the opaque enema can be entirely dispensed with, but agree with Brown and Sampson that the ingested meal gives the best and most reliable information. However, the opaque enema occasionally gives us additional information and assists in checking our diagnosis.

* Read at the Ninth Annual Meeting of the American Congress of Physical Therapy, St. Louis, Mo., September 8, 1930.
†From the Tucson Clinic.

Recently I have heard it said that filling defects are not present and should not be looked for. However, this is not entirely true; filling defects are seen but are usually small. Yet, the intestinal spasm (that is, spasm of caecum or ascending colon) with its consequent rapid emptying, is of the utmost importance. It must not be forgotten that we get caecal spasm occasionally with appendiceal pathology and probably rarely with other local intestinal or pelvic pathology. Spasm of the terminal ileum is sometimes seen if closely looked for and is probably of definite significance. Spasm of the transverse colon in the presence of spasm of the caecum or ascending portion would indicate extensive intestinal involvement, but alone, would suggest the possibility of other local pathology.

It is readily seen that intestinal tuberculosis must be *differentiated* from all other bowel conditions. The presence of lung tuberculosis would be the most important influencing factor. However, we must remember that tuberculous patients are extremely prone to *functional colitis,* either as the result of a toxic influence or because of the nervous condition caused by the tuberculosis, and so it probably heads the list. Anyone who is treating many patients with pulmonary tuberculosis naturally comes in contact with cases of functional or spastic colitis. Occasionally *protein sensitization* is the explanation of a chronic or mucous diarrhoea. Simple or non-tuberculous *ulcerative colitis,* although not a very frequent disease is now, because of better diagnosic methods more frequently diagnosed. Probably a completely negative chest or the proctoscopic findings decides between the two. Another condition—*amebic dysentery*—as well as other protozoal infestations should be kept in mind, and if for no other reason stools should be run. Warm stools are usually more satisfactory for this examination. In the older patient we have to constantly distinguish between a tuberculous colitis and a *malignancy.* Usually the x-ray examination and the proctoscopic examination will take care of this. As a rule *tuberculous peritonitis* with fluid is not hard to differentiate but oftentimes in the early history of this condition, days and even weeks elapse before this differentiation can be made. The development of fluid and the careful x-ray study are very helpful.

Treatment

Not so many years ago the only attempt at active treatment of intestinal tuberculosis was to find a definite localization of the tuberculous ulceration, usually in the caecum with a view to surgical resection. This was done innumerable times but with very little success, and this method has been given up, except in very rare instances, when occasionally an infiltrative lesion of the tip of the caecum is found.

When one talks of the treatment of any form of tuberculosis *rest* is always stressed and should be stressed a great deal more than it is, and this is still more necessary with the bowel complication. To quote Dr. Clendening from his book on therapeutics, "Rest is the best therapeutic measure the physician has in his armamentarium." Unfortunately there is very little that can be written about it, but those individuals who impress the profession properly about it will eventually rank as real benefactors. We invariably insist in these cases on one hundred per cent absolute bed rest—that is, never leaving the bed and prohibiting bathroom privileges. We do not even allow these patients to sit up in bed. This does not apply, of course, to the convalescent period. Time and again it is driven home to us that very strict discipline in these details means the difference between improvement with disappearance of the symptoms and non-improvement. The importance of this strict type of rest cannot be exaggerated. When we consider how important this is, and that with few exceptions it is within the reach of all, we cannot help feeling that we as physicians are remiss if we do not order it and enforce it in the right manner.

The question of *diet* in the treatment of Intestinal Tuberculosis has been unfortunately over-stressed. Probably the natural thing to think of first in the treatment of a bowel condition is the diet. However, it is of almost the least importance. Possibly many of the cases properly treated otherwise will do well on a mixed diet. However, it is our custom to use a *modified bowel diet,* leaving out such irritants as acid fruits, fats, sweets and foods with very coarse fibres or hulls. Often we put such patients on Alvarez' Smooth Diet. Cases, however, with marked symptoms, especially severe pain or diarrhea are kept for sometime on a much more strict bland diet,

possibly even confining the diet for many days to watery cereal gruels and scalded milk. Also in such cases we push the bismuth and chalk powder and if the flatulence is great the belladonna, or belladonna combined with sedatives, such as luminol or bromides.

We rarely use opiates for the diarrhea, but occasionally for a time, advise paregoric or the crude powdered opium.

A number of years ago we used *calcium* intravenously for all of our cases of pulmonary tuberculosis but soon gave it up. However, at that time we were convinced that in a few cases of severe bowel complication we did secure some relief from the pain and diarrhea. When we give calcium for this condition we usually give an injection intravenously, daily, for six consecutive days, and then continue it once or twice a week.

We have always considered tuberculin therapy in properly graduated doses as being indicated in about all the complications of pulmonary tuberculosis. But our experience with tuberculin in these cases is meagre and we cannot properly evaluate this therapeutic measure in this report. Our limited experience, however, does not indicate much hope in this direction, although further observations will be made.

Becoming interested in Dr. M. McConkey's[2] work in the treatment of Intestinal Tuberculosis with cod liver oil and tomato juice, the results of which were published a few months ago, we have treated a relatively large number of cases in this manner with very gratifying results. He prescribes one tablespoonful of pure cod liver oil on top of three ounces of tomato juice (served ice cold) after each meal. Personally, I confess that heretofore I had hesitated to give that much of either the cod liver oil or tomato juice to our patients, but after trying it a while I do not hesitate in prescribing this dosage. Dr. McConkey points out that orange juice is interchangeable with tomato juice and we have used sometimes one and sometimes the other. As is readily seen this combination contains a large amount of all the vitamines. This treatment was tried because the cod liver oil was considered to be an anti-rachitic remedy equal to ultraviolet radiation. The individual is presumed to have enough such radiation to activate the vitamines, after which activitation they take care of that all-important condition —the calcium-phosphorus balance.

This brings us to the question of *ultraviolet radiation*. A few words may not be amiss about our local conditions. Although we can give sun therapy all the year 'round, barring an occasional cloudy day, the fall, winter and spring months are better than the summer months for this purpose. The heat rays are so abundant in the summer that not a great deal of time could be with advantage spent in the sun. This difficulty is obviated somewhat by having those patients take their sun treatment very early in the morning—at seven o'clock or even earlier. Thirty minutes in June is equal to an hour and a half or two hours in the winter. It has become our policy to advise many of our patients to take air baths or "skylight" baths in the summer time. As the names imply the patients are not in direct sun but get a great deal of reflected ultraviolet radiation.

I wish to say, however, that although we use the sun and the ultraviolet lamp interchangeably, that in this particular complication we are partial to the lamp. We feel that it is more even and more easily controlled. Very often we transfer a patient from lamp treatments to sun therapy after six or eight months, when for financial or other reasons the lamp cannot be maintained. Do not forget that whether it be the sun or the lamp, we refer to general ultraviolet radiation — that is, all over the body, except that the lungs should be invariably covered.

The danger of overdoing the radiation cannot be stressed too much. We see evidence right and left of much harm from over-radiation. If there is any question about it we always temporarily stop the radiation or reduce it markedly. We rarely work up to more than an hour radiation with the lamp at thirty-inch distance—that is, thirty minutes on front and thirty on back.

In the last year we have had two classic examples of cases sensitized to ultraviolet radiation. Neither of the cases could take either sun or lamp treatment, although one case for a time did take as much as fourteen minutes of the lamp (seven anteriorly and seven posteriorly). Repeated trials with either case made them much worse. There are probably a number of such cases with even more mild sensitization.

Conclusions

In this preliminary report we have not tabulated our cases but we have a large number

who have been symptom-free for sometime and have also remained so after the withdrawal of the radiation. We never think of stopping the radiation for some months after we fail to find x-ray evidence of activity; that is, negative for active pathology in the bowel. We do not wish to leave an impression that all the cases so treated responded favorably. However, it is our belief that a great many of the bowel complications of tuberculosis if seen early can be successfully treated.

References

1. Intestinal Tuberculosis — Diagnosis and Treatment. *Lawrason Brown, M.D.,* and *Homer L. Sampson.*

2. The Treatment of Intestinal Tuberculosis with Cod Liver Oil and Tomato Juice. *M. McConkey, M.D.* (National Tuberculosis Association Transactions, 1929.)

3. Tuberculosis of the Bowel from the Standpoint of the Roentgenologist. *James L. McKnight, M. D.,* Tucson, Arizona. *Southwestern Med.,* Aug. 1930, page 365.

Discussion

Dr. Benjamin Goldberg (Chicago, Illinois): Personally, I feel that the benefits to be derived from ultraviolet may be summarized as follows:

1. The bactericidal action. This beneficial action is obtained through direct, local application of the rays, whenever possible, in the case of skin, laryngeal, open bone, and open glandular tuberculosis.

2. General action. Under general action we must take up for consideration the effect upon the entire human mechanism, upon the physiology and physiological chemistry of the body and upon metabolic function. We must, for instance, consider the action upon the sterol content of the fatty layer of the skin.

It is considered by competent authorities that the action of the violet ray on the skin sterol creates the substance Vitamin D which is so essential in our bodily chemistry. Vitamin D is essential in the calcium and phosphorus metabolism so necessary to our well-being. Derangement of calcium and phosphorus metabolism leads to rickets, to change in the hydrogen-ion content of the blood, and to acidosis; clinically, to gastro-intestinal disturbance, nervous disturbance as tetany, and respiratory trouble.

The regulation of calcium and phosphorus metabolism is particularly important in tuberculosis and the improved tone of this phase of metabolism would seem to be a definite factor in determining the resorption of the exudative process as well as in stimulating new factors of resistance which operate toward disease localization and restoration of function. In addition to metabolic change, other physiological changes, as blood changes, are noted. Coagulation time is increased, probably as a secondary result of increased calcium content; there is a tendency to increase of reds and, according to some authorities, also an increase of lymphocytes. Saleeby and others have noted an increase in the iron content.

As regards the *modus operandi* of the physiochemical changes, it is necessary to admit that considerable doubt still remains. According to Hess, ultraviolet irradiation changes the chemistry of cholesterol, as shown by a definitely altered spectrum. The altered sterol of the skin, according to certain authorities, or one or more of its constituents is taken up by the sub-epidermal capillaries. Whether Vitamin D is one of the end products of chemical change, formed *in loco,* or whether Vitamin D is later formed in the tissues as an expression of complicated tissue reaction, is undecided.

Subjectively, general action properly controlled in most individuals, results in a feeling of exhilaration, buoyancy, well-being and warmth. Mental activity seems improved and fatigue and depression diminish.

A word about the general action on the endocrine system. In this matter we can allow ourselves only extremely general deductions. The thyroid and sex glands appear particularly influenced. Revilliod has successfully treated myxedematous children by heliotherapy, even in the absence of thyroid extract. Hasselbach has successfully treated goitrous women with a quartz light. Grant and Gates of the Rockfeller Institute have found that the endocrine glands increase in weight as the result of irradiation. The parathyroids, particularly, show marked increase, varying from an increase of 14.1 to an increase of 51.1 per cent. This is particularly interesting in view of our conception of the parathyroid role in calcium metabolism.

A few words as to therapy. Concerning the types of tuberculous lesions treated, I feel we should classify the cases treated in two distinct groups: (a) Pulmonary. (b) Extra-pulmonary.

Pulmonary cases. In this group the indications are extremely limited. You have heard Dr. Forster bring up that matter for discussion. It is a little over seventeen years ago that I first treated a group of individuals with pulmonary tuberculosis by means of heliotherapy. Perhaps I wasn't as cautious then as I might be today in using heliotherapy, but at any rate we saw in individuals who had exudative lesions at that time a marked increase in the extent of the exudative lesion. I developed a deep respect for this procedure as regards pulmonary tuberculosis, especially in exposing the entire body or the chest to the sun's rays, or later to artificial ultraviolet. It is only in the quiescent, limited, fibroid tuberculous process that heliotherapy plays a safely curative role. And I say that because I feel that it takes an individual who has had an extensive experience in handling pulmonary tuberculosis to determine the presence of the exudative process sufficiently well to make certain that heliotherapy might be applied, even in some of these exudative processes that have a minor activity.

The individual case must be studied closely

with the knowledge that heliotherapy in unsuitable cases may be definitely harmful. Exudative processes in the lung form definite contraindications to the use of heliotherapy in the treatment of such pulmonary lesions.

Extra-pulmonary cases. The extra-pulmonary types of tuberculosis amenable to actinotherapy are, in the order of their response to treatment:

1. Glandular.
2. Peritoneal.
3. Skin.
4. Bone.
5. Laryngeal.
6. Genito-urinary.
7. Enteric tuberculosis.

It is almost a specific in glandular tuberculous lesions which are not broken down and in certain types of skin tuberculosis. It may be also considered a saviour of many lives in the latter part of the above grouping, previously considered hopelessly ill.

Heliotherapy, either natural or artificial, we may now hail as a therapeutic procedure which saves many lives and which prevents considerable crippling and deformity, particularly in children. That has definite value so far as handling these forms of tuberculosis is concerned.

In considering the forms of ultraviolet therapy, the discussion naturally hinges on the fact as to whether greater benefit may accrue in the individual case from the use of artificial or natural ultraviolet irradiation. In a general way it may be said that in many instances, when available, a combination of the two modes of therapy is advisable. In the presence of abundant, continuous, daily sunshine, we feel that natural ultraviolet aids much in stimulation of general metabolism and in stimulation of the healing process. The associated air bath incident to this treatment, with the cooling breeze on the surface of the skin, creates a firm, elastic, muscular tonus and seems to have more tonic effect than the unaided artificial heliotherapy. Where natural sunshine is not adequately available, in certain local conditions, and in cases in which absolute, accurate dosage of ultraviolet is essential, artificial heliotherapy, either by means of the quartz or carbon arc lamp units may be the mode of preference. In laryngeal and skin tuberculosis, for instance, measured, properly applied dosage is easily obtainable through artificial means. The local application, however, whenever possible, may be properly supplemented by general irradiation and direct sunlight.

Permit me a few more moments to say a few words regarding Dr. Callander's presentation. About three years ago I read a paper before the National Tuberculosis Association on "Pathologic Studies of Tuberculous Enteritis," and reported a series of 230 autopsies on tuberculous individuals, of which we found that 184 showed evidence of tuberculous enteritis, which is approximately eighty per cent of such individuals who had died with tuberculosis. I mention this because in studying these specimens as they came from the post-mortem table we found that several individuals who had not died of tuberculosis but had died of accident in the course of their tuberculosis, showed a definite tendency to healing of the tuberculosis, and in two instances it helped out the tuberculosis.

It is definitely known that tuberculosis involving the mucous membrane alone may heal, leaving no residual scars, but as tuberculosis involves the deeper tissues of the bowel and intestines, as in other parts of the body, the ulcerative processes tend to extend.

This question of healing of tuberculous enteritis spontaneously brings up the proposition that for some time has had considerable study, particularly in the East. Mayer of Saranac Lake reported healing of tuberculous enteritis. A great many individuals have felt that tuberculous enteritis might heal spontaneously and that the healing is not due to any ultraviolet treatments or heliotherapy that might be used. In these patients, elderly persons, though we have seen evidence of definite healing of tuberculous enteritis without heliotherapy, yet we feel that the value of heliotherapy, plus the value of diet, is most important. When we say diet and therapy we mean the influence on the body chemistry to be determined by the feeding of the diets balanced in vitamins, balanced in the various chemical components, and having a balance of proteins, carbohydrates and fats.

In the research department of the Municipal Sanitarium of Chicago, which organization I am happy to direct, we have for a period of five years now been doing research on diets in tuberculosis. We have definitely shown in animals the ability of guinea pigs inoculated with tuberculosis to withstand the disease when placed on a diet adequate in these various substances. When placed on deficiency diets they developed tuberculosis. The work of McConkey has been mentioned as an outstanding bit of work in this type of dietetic feeding and management. He contended that tomato juice and cod lived oil made up the deficiency in vitamins and that those deficiencies were not ordinarily made up in most institutions or in handling patients in private practice.

In concluding, I should say that it is most important for the phthisiotherapist to remember that heliotherapy is merely one factor in the treatment. The tuberculous patient must be studied as an individual and routine tuberculosis therapy must underlie and form the basis of the whole treatment program. Rest, good food, and fresh air must still form the backbone of the tuberculosis cure. Against this background, properly conceived and carried out in conscientious detail, the comparatively new procedure of ultraviolet therapy will secure its best results in the treatment of tuberculosis.

Dr. Louis C. Boisliniere (St. Louis, Missouri): I am a visitor and I feel hesitancy about addressing you or talking to you at all. I have been very much edified by all that I have heard this evening and very much enlightened. I feel that those who have gone into it know so much

more about the subject than I do that I would rather deal for a moment just in generalities.

At the recent meeting of the British Medical Association, Lord Moynihan made a very good remark. He said that ideals are more for pursuit than for capture. The attitude with which these ideals are being pursued by all those present reminds me somewhat of the assiduity of the Missouri hound dog. He gets on the trail of an animal and you can hear him baying. You can tell by his yell whether he is on the wrong trail or the right trail. Oftentimes he pursues the wrong trail with the same enthusiasm but pretty soon you can tell by the change in his tone that he is on a path that has been beaten before. He will pursue this animal but as soon as he attains his objective he turns his tail and walks away. So Lord Moynihan said that ideals are more for pursuit than for capture, but in the pursuit of our ideals if we run across an approximate rule for efficacious action we have attained everything that we need to attain. It is just like many other things. How many troubles are there? Take malaria. How well we know how to cure malaria. We attained the ideal in the pursuit of it.

In regard to heliotherapy, unquestionably the benefits of it have been laid down in extra-pulmonary tuberculosis. The use of heliotherapy in pulmonary tuberculosis is still a mooted question and has to be approached with the utmost of care.

In regard to heliotherapy in the light treatment, I must say that we got very excellent results in the beginning from Dr. Forster's apparatus that he put up in our institution.

I was very much pleased with Dr. Singer's paper. It shows that although we may have a certain technic, that technic can be vastly improved upon by those who concentrate upon it. Mr. Chairman, I thank you. The hour is getting late.

Mr. C. E. Greider (National Carbon Company, Cleveland, Ohio): I can't add anything to the discussion here. My work has been entirely on the physical measurement of light sources. Some results of that work are to be published in the near future. We have measured the distribution of natural sunlight both in Colorado, at Dr. Forster's sanitorium and a station in Ohio. It is hoped that the physical measurements of the natural sunlight can be offered as a satisfactory basis for comparing natural sunshine and the various types of artificial light in those places.

Dr. J. J. Singer (St. Louis, Missouri), closing remarks: I feel very much like the paper on x-ray was a little bit out of place in the program, but I was glad to have the opportunity to present it. I merely want to say one thing about it. I think it was Dr. Kobak who asked about the various types of lesions that were treated. I am certain that if more x-ray work is done and more careful studies with x-ray are made, you could put over a good deal with diathermy in pneumonia. I know in our own hospital it has been used rarely because the facts, so far as we know, have not been properly proven. They may be proved to some and not to others. I am not antagonistic. I just don't know. We would be only too glad to welcome very definite information so that we do not lose a valuable adjunct that some of us know very little about.

Dr. Kettlekamp: I should like to ask Dr. Forster a question. In the case, Dr. Forster, of a patient with progressing pulmonary lesions which we discover in the unilateral renal condition, how do you feel about treating that patient—conservatively with heliotherapy or by radical surgery?

Dr. Forster: I think I did not get that question. You said unilateral pulmonary?

Dr. Kettlekamp: Unilateral kidney condition and pulmonary chest condition, progressing.

That pulmonary condition is no doubt affected by the kidney condition. If you take out the kidney wouldn't it affect the other?

Dr. Forster: That brings up a very interesting question. You see more and more in the literature in regard to the results of various surgical procedures on the pulmonary condition along with extra-pulmonary complications. For instance, we know that other extra-pulmonary lesions do respond very nicely to control by artificial means of the pulmonary condition. Of course, that leads us a step further to the general belief that the pulmonary lesion is the reservoir from which these extra-pulmonary lesions develop. Of course, I am not prepared to say that it is an advisable thing to let the unilateral kidney lesion go without surgical intervention, but I do absolutely agree with the growing belief that where we can artificially control that pulmonary reservoir we can get very definite relief in the extra-pulmonary condition. Does that answer your question?

Dr. Kettlekamp: Yes.

Dr. Forster: It just occurred to me that possibly because Dr. Titus lives under an anti-prohibition influence in New York he attributes all of the benefit to the whisky when he should attribute it to the diathermy.

Dr. Alexius M. Forster (Colorado Springs, Colorado), closing: The chairman sounded a note that I myself have felt; that these gentlemen interested in physiotherapy are not particularly interested in the subject of heliotherapy. It is becoming more and more recognized that there are other conditions besides tuberculosis in which heliotherapy is a valuable aid in their treatment. Of course, it is also recognized, as the chairman has so aptly said, that heliotherapy is only one phase in the treatment of tuberculosis, and naturally it is only one phase in the treatment of its conditions. With the growth of the recognition that heliotherapy is not a specific for tuberculosis, which grew out of the fact that Rollier's work was confined to tuberculosis, more and more reputable men are using heioltherapy for other conditions. Since those of us who have done the most work recognize very clearly that to a large degree heliotherapy has its effect on metabolism and on general conditions and is not a specific for tuberculosis, we feel that if men, particularly this group, who are interested in physiotherapy, would pay more attention to heliotherapy that interest would grow

and that it would be applied to a wider scope of conditions than simply to tuberculosis.

As a matter of fact I think Dr. Callander can tell us that down in his part of the country they are using it quite scientifically for sinus conditions, for arthritis, for certain forms of kidney disease. We in our part of the country feel that we get benefit in asthmatic conditions, and the field for the use of heliotherapy is much wider than that of tuberculosis alone.

I certainly want to join with Dr. Kobak in congratulating the chairman on the masterly way in which he has conducted this meeting and the way in which he discussed the various papers that were presented. I don't want to presume to differ with him or the other speakers in regard to the use of heliotherapy in pulmonary tuberculosis, but I must confess that in my experience, if it is given at the proper time and with carefully gauged control, we do get the same effect on the pulmonary lesions that we get on the extra-pulmonary lesions.

I want to emphasize the fact that I believe the great trouble with the use of heliotherapy in pulmonary tuberculosis, as well as in other forms, lies in overdosage.

I was interested in what two of the speakers said. I think they mentioned the question of sensitivity to light. I certainly think that those cases are bettered. I have seen a number of them myself. I have never seen a case which could not with care and precision be desensitized. I have in mind a patient who for a period of years has not taken over six minutes of heliotherapy, and even in that time he gradually got desensitized. He went up to three or four hours a day and got most excellent results. I don't think it is the amount of heliotherapy that you give but the individual's reaction to it that counts. I believe that this individual who did not take more than six minutes got a distinct benefit during that time. As a matter of fact, it is customary for us to see cases who were doing splendidly on heliotherapy at first where the effect slows down. I believe that the only reason for increasing the dosage is in order to get the maximum reaction within the bounds of safety for that individual. I think that the whole secret of the use of heliotherapy, as the chairman has so aptly said, lies in the individual situation. If we only watch the patient carefully enough and only apply the treatment with the utmost care and attention to all of the symptoms, I don't believe we are going to do harm to any of the cases. Even, as has been mentioned, if we simply give them the benefit of the air bath, these benefits apply to the extra-pulmonary cases as well as to the pulmonary tuberculous cases.

Dr. Kobak: May I ask Dr. Forster a question? In those cases where you found that the effect of heliotherapy was not as progressive or satisfactory, have you ever tried some photochemical diets on your patients?

Dr. Forster: Yes, we have. We have used several of them. You know what I mean. I can't think of its name. In the case of tuberculous empyema, we used them in the large rings. We are not able to see that we got any particular benefit from their use.

Dr. Copeland of the Bureau of Standards suggested to me several years ago that if we could find some fluorescent substance that could circulate in the blood, or that possibly we could put in the lung by the regular method, we might get some more definitely localized effect. Of course, that has been the whole question on these tuberculous lesions: How much local effect do we get from the heliotherapy? I don't happen to know. I am not sufficient a chemist to know of any fluorescent substance that can be put directly on the site of the lesion and that can be affected by heliotherapy. I think it is a very interesting question and one that may probably be studied.

I should like to ask Dr. Seybold a question about the use of the oxygen in connection with the use of diathermy in these cases of pneumonia.

Dr. R. J. Callander (Tucson, Arizona), closing: I shouldn't add anything, but Dr. Forster brought up a question of using heliotherapy on other things besides tuberculosis. We have used some in sinus cases and in very recent years some in arthritis cases with very satisfactory results.

I feel, since he has brought it up, that we haven't used it as much as we should in asthma cases. What I wanted to say chiefly was that we used it in functional bowel cases, spastic mucous colitis cases, some of them quite severe, with very splendid results. I wanted to bring that point out chiefly.

HYDROGYMNASTICS IN INFANTILE PARALYSIS *

K. G. HANSSON, M.D.
NEW YORK

The after-treatment of infantile paralysis has undergone various changes during the last 40 years. Up until 1890, all after-treatment consisted in the application of braces and supports. Toward the end of last century operative orthopedics developed under such men as Sir Robert Jones, Adolph Lorentz and Royal Whitman. By stabilizing operations on the skeleton or by balancing operations on the muscular system many braces were discarded and many invalids were put back on their feet in useful occupations.

During the first decade of this century the muscle re-education exercises of Dr. Lovett added greatly to the rehabilitation of the victims of infantile paralysis. The rational principle in these exercises is simple. In a patient with infantile paralysis we have destruction of part of the anterior horn cells of the spinal cord. There is probably no regeneration of these horn cells. The quantity of nerve fibers to a given muscle is, therefore, decreased. The quality of the nerve-impulse to this same muscle can be increased. We also have to consider the contractibility of the muscle as a varying factor which we may influence by proper training.

During the second decade and especially during the world war the electrical modalities were used to greater extent in the treatment of infantile paralysis, especially the Sine wave currents and high frequency and static currents.

It was during the third decade that we saw the introduction of under water exercises. Dr. Lowman in Los Angeles has developed many of the scientific points connected with this treatment, Dr. Hubbard at Warm Springs, Georgia, backed by Governor Roosevelt, of New York state, has helped to popularize hydrogymnastics, and Dr. Childs, of Port Jefferson, Long Island, is another pioneer in this form of treatment.

My first experience in under water treatment dates back to 1914, when I was surprised at seeing a man of 40, a victim of infantile paralysis for 10 years, deport himself with ease in the water. He was unable to walk without help of crutches and spent most of his time in a wheelchair. He took his under water exercises in one of the out of the way places of the world, a small island, Isle of Pines, south of Cuba.

In order to understand this form of treatment we must first discuss the therapeutic pool. This is not a swimming pool and is not intended for swimming. It is built up from the floor, and the size varies. Our pool at the Hospital for Ruptured and Crippled is 26 feet long and 12 feet wide. The depth is 4 feet at one end and 2 feet at the other one. The height of the pool over the outside floor being the same as the height of the hospital stretcher makes it easy for patients to get into the water. The interior of the pool is fitted up with plinths or other supports which are necessary for the fixation of the patient. An over-head track is also useful for this purpose. The water must be filtered and sterilized, and bacteriological tests made to prevent pollution. The temperature of the water should be between 85° to 95° F., because polio patients chill easily and kidney complications may result. A shower must be available nearby so that all patients can pass through this before entering the pool. It is also advisable to have some form of a solarium, where patients may be radiated with ultraviolet rays. This also secures a rest and complete dryness before the patients leave for dressing.

However, it is not sufficient to have an expensive installation: we must know how to use it. The exercises we use are the muscle re-education exercises of Dr. Lovett, although applied in a new medium. The treatment requires 15 minutes. The first 5 minutes are devoted to special exercises, such as might be given for the calf muscles for example. The next 5 minutes are used for general coordination exercises, as for instance walking in the water; and the last 5 minutes the patient undergoes some applied exercises, for example, diving.

The scientific principles on which hydrogymnastics rest are as follows:

* Read at the Ninth Annual Meeting of the American Congress of Physical Therapy, St. Louis, Mo., Sept. 10, 1930.

I. Archimides principle — i.e., a body submerged in water will lose as much in weight as the weight of the displaced water. This will be shown on the screen where a boy who weighed 44 lbs. in the air when submerged in water only weighed 2 lbs. It is easy to see how such a loss of weight will help a weakened muscle to perform its function in water when it is impossible out of water.

II. The buoyancy of the water neutralizes gravity in such a way that the resistance is equal to movements in all directions.

III. The water undoubtedly stimulates the cutaneous nerve endings producing what we like to call good reaction, which is nothing but an increase of the general body function.

IV. When the human body is taken from its normal element and placed in a new medium such as water, there is undoubtedly an obscure reflex present, which tends to extend the body, and this reflex we might call extension reflex. Everybody has observed how we subconsciously curl up into flexion when going to bed, and how we subconsciously stretch out into maximum extension in water, very much the same as we do when we yawn. This is made use of in postural treatment.

V. The psychological effect of this treatment on children is astonishing. I have seen mothers weep from joy when they watched their children in the water. The lethargic crippled child who has been limited to his bed for many a long day begins to take a new interest in life, and if you can turn this new interest into beneficial activity you have gained half of your purpose in the treatment. (Demonstration of moving picture film.)

Although the subject of my talk was hydrogymnastics in infantile paralysis we must not draw the conclusion that other pathologies are excluded from this treatment. It is also applied in spastic paralysis, certain types of arthritis, fractures, scoliosis, postural defects, sciatic scoliosis and, as after-treatment, in arthroplastics and other operations on the joints.

Conclusion

In conclusion may I say that hydrogymnastics do not take the place of the other recognized orthopedic measures in the treatment of polio-myelitis. Orthopedic operations are more important than ever before because of improved technic; braces and other supports are necessary. At the Hospital for Ruptured and Crippled we still use the dry gymnasium, and also the low tension electrical currents. Hydrogymnastic treatment, however, is the important part in the rehabilitation of residual paralysis in polio-myelitis.

Discussion

Dr. F. H. Ewerhardt (St. Louis, Mo.): I saw Dr. Hansson's pool in New York, and while he was talking I visualized the entire technic.

Some of the main things in the treatment of polio-myelitis is the avoidance of fatigue, the avoidance of stretching, the stretching of the muscles, the avoidance of improper muscular movement. Fatigue is caused ordinarily by improper splinting, by too much exercise, by too much massage. Stretching is brought about by improper splinting and by an imbalanced muscular development; that is, by giving in case of a leg involvement, a general exercise. It means the healthy muscle will become stronger and the diseased muscle may become a little bit stronger, but cannot catch up with the normal one, consequently the result is imbalance.

The desideratum, the chief thing we are all after in the treatment of polio is to get the child to do a voluntary exercise after the fatigue and stretching ideas have been taken care of. We want the child to do a voluntary exercise. It doesn't do the child much good to have somebody else do it for him. We therefore strive to create voluntary exercises in some form.

In the past, until hydrogymnastics became a regular part of the treatment, we had to resort to movement outside of the pool. We meant to obtain exercise against gravity and against resistance. All this is taken care of by means of exercises under water. You heard Dr. Hansson say that a body weighing 42 pounds out of the water, weighs only 2 pounds; which means there is a tremendous gain in ability on the part of the individual to perform voluntary exercise.

That brings us to the last point I want to bring out, that is the morale. Once a child knows that it can perform a voluntary movement, as Dr. Hansson said, the battle is half won. It is to get the child to do the voluntary movement, try to stimulate the impulses from the brain to create voluntary efforts down to the muscle, that is the big objective. That can be so much better brought about in the pool than outside. Therefore, I feel this advancement in the treatment of polio in the pool has been of tremendous importance.

Dr. J. S. Coulter (Chicago, Ill.): I believe there are certain advantages possibly to a large pool, and there are certain advantages to the other kind of pool, the smaller pool. The smaller pool, especially in general hospitals where you do not see so many orthopedic cases, you can build very much easier than Dr. Hansson's. Then, in addition, there is the so-called Hubbard tank. I think it has a very definite use in home cases. We see a great many cases in Chicago that we cannot hospitalize and that we cannot

transport for various reasons, or on account of the large size of the city, they are scattered about a great deal. I think in those cases the so-called Hubbard tank, which is a tank so built that you can get full abduction of the arms and full abduction of the legs, about seven feet long and about arm to arm wide, has certain advantages. It is about two and one-half feet deep. I think it has a certain advantage for under water exercises that you can use at home.

The University of Chicago, in their physical therapy department on the South Side, in their Orthopedic Department, are putting in a small pool, and they are putting in, in addition to that, this Hubbard tank to instruct certain patients who will go away from that place to smaller towns where they can install one of these tanks in their own home. You can buy them for seventy-five dollars. You can put them in any cellar. You fill them from an ordinary hydrant. They have certain advantages.

I think there is one thing that everybody who is active in the problem of under water gymnasium work should watch especially, particularly in public school work. We do a lot of public school work in Chicago and I think that there is a tendency to use this pool a lot of times for swimming. I think Dr. Hansson emphasized that, and I think it ought to be emphasized again and again, that under water gymnastics is not swimming.

I might add we do some industrial work and we use this under water exercising a great deal following back injuries, both with and without spinal cord injuries, and it has been very effective in that treatment.

Dr. Norman E. Titus (New York City): As in most treatments with physical therapy, when a new treatment is mentioned to those of us who are interested, very frequently the cost of equipment scares people from adopting it. I want to assure you that you can do under water gymnastics without expensive equipment. Of course, it is ideal to use a tank and the most ideal is such as Dr. Hansson has, where you can have the patient suspended from a trolley on a canvas carriage, where they can be on a table and the leg board dropped down or the arm board dropped down. Such is ideal, but, of course, expensive.

At the Vanderbilt Clinic in New York we were unable to persuade the powers that be — the ones that hold the check book — that such a tank was of any use, and so we were rather cramped, and have been, in doing complete hydrogymnastics. I mention it to you because we have been quite successful in using an ordinary bath tub, such as is supplied in the hydrotherapeutic department for continuous baths especially, mainly in the treatment of paralyses of the legs. We fasten the canvas sling to the sides of the tub and then drop it from the buttocks down and the limbs will float in the water. We are able to do some very successful hydrogymnastics in that way. It really has been surprising to me the great speed that has been made in cases of polio affecting the legs, when the exercise is carried on under water, compared with what we were able to do before.

As Dr. Hansson said, it is not confined to polio alone.

To perhaps digress to show you how we get away from having big, expensive pools, which I hope we will have some day, in paralyses of the upper extremities, we adopt a method that Dr. Koker mentioned some time ago, of having the patient lie on two tables of exactly the same size and then for abduction exercises of the arm, we just powder the table and the arm slides along on the table without any effect of gravity which helps us a great deal in our remedial exercises.

Of course, the principle of all this work is largely muscle reeducation. I know there are many people who think they can't do anything with such exercises unless they spend a lot of time and study and they must have a lot of fancy equipment. That is not true. I think I am correct in saying there has never been any condition in the extremities resulting in paralysis that meant a total paralysis of all muscles concerned in a certain motion. Perhaps Dr. Hansson will correct me on that. I have never seen any cases myself where there was an absolute inability to do a certain motion through the complete paralysis of all muscles concerned.

In late polio cases, it is remarkable to see what can be done to reeducate the accessory muscles, to teach those that are relaxing to relax better, to teach the accessory ones that should become spastic to carry on the motion, to do their work better. Those of you who have not followed remedial exercise and gymnastics will be surprised to see what can be done.

As Dr. Ewerhardt (I think it was) said, active motion is necessary. We have to sometimes use electrical stimulation, but it is active motion that does the work. You all will be surprised to see what wonderful work can be done by the patients when the extremity is immersed under water. It is really a remarkable procedure.

Dr. K. G. Hansson (New York City): I forgot to mention one thing: that children suffering from infantile paralysis, after being exposed to hot water, very easily get chilled, and you have to be very careful that they don't develop some kidney complication. They are very apt to do that, especially if the treatment takes too long a time, or if they are not properly taken care of immediately after the treatment.

I had expected somebody to take up the discussion and inform me something about these extension reflexes which I am trying to work out but have not reached very far with. I think there is a very interesting reflex, probably obscure, and inherited through evolution, that can be made use of. We know we have the posture reflexes that we make use of in body mechanics, the upper body reflex, the lower body reflex, and the crossed course reflex. They are probably remnants from the quadruped stage of locomotion. That is, if you extend your left leg, the right upper scapula will go into flexion. The extension reflex is probably one of the same nature.

One word about Dr. Titus' statement that all paralytic extremities will show some motion. These are very often trick movements that the patients have learned, and you have to be very careful that you don't get fooled in analyzing these movements. The most typical is probably the one in the lower extremity with the tensor fasciae latae. This muscle seldom becomes paralyzed; even with the other muscles of the lower extremity paralyzed, and they get a certain amount of trick motion in the lower extremity. That also applies to the upper extremity, and you have to be careful, as I say, in analyzing these trick movements so that they don't lead to increased deformities.

Dr. Ewerhardt: May I ask how soon after the onset of disease do you put your patients in the pool?

Dr. Hansson: That is another advantage of the hydrogymnastics that I forgot to emphasize. The general rule is no treatment should be undertaken until the pain has disappeared.

In hydrogymnastics you can start earlier, and as soon as the temperature has disappeared there is no danger in immersing or submerging the patient in the water. This we often do at the Hospital for Ruptured and Crippled just outside the ward by lifting the patient off the bed with a sheet and submerging him in an ordinary bath tub with a hypertonic solution of salt. I have never seen any bad results from too early treatment. At our hospital most of the patients are sent for treatment six weeks after the onset of the disease. I think you can make use of this treatment before any other treatment can be instituted in polio.

THE APPLICATION OF DIATHERMY IN SURGERY OF THE RECTUM *

WARREN R. RAINEY, M.D.
ST. LOUIS, MO.

Surgery of the rectum is rapidly becoming recognized as a distinct specialty. New methods, new instruments, and new forms of treatment are always appearing in every advanced field of medicine. It is very important that in the application of these newer agents one does not overlook the underlying principles of surgery, nor forget the advantages of a thorough understanding of the pathologic processes to be treated. Diathermy, both in the form of spark and coagulation is quite an adjunct and enables the proctologist to do many things much easier and with more satisfactory results than he is able to obtain by some of the older methods. Unfortunately, through an over-enthusiasm on the part of certain representatives of diathermy apparatus, claims have been made for the various procedures which are not in keeping with their real accomplishments. Physicians without sufficient knowledge of the pathological conditions that occur about the rectum are misled into believing that rectal lesions are comparatively simple affairs and that with no inconvenience to the patient all ailments appearing in that region can be relieved by the use of the diathermy in the office of any practitioner.

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Hemorrhoids

As far back as man's knowledge of medicine has been recorded hemorrhoids have appeared frequently in all the ancient literature. The actual cautery as an accepted form of treatment is old beyond our knowledge. Very little improvement has been made in the cautery except that a continuous heat can more or less be secured in the electric heating unit, as well known to the plumber and mechanic as to the surgeon. Diathermy by the coagulation method offers a decided improvement in the control and distribution of the heat. The cautery has never been applicable to all types of hemorrhoids. Its selection should be limited to the internal variety, and this is likewise true of the diathermy. If it is necessary to remove a hemorrhoid in which there is an extension, of the internal type within the true skin, or beyond the mucocutaneous juncture, it is advisable to use a combination of suture and diathermy or suture and cautery. In other words, none of the mucocutaneous or true skin should be included in the tissues to be coagulated. If this rule, which has long been a principle in rectal surgery so far as cautery has been concerned, is strictly applied, the surgeon will not be embarrassed with the resultant ulcerations of the skin which are very painful and hard to heal.

Secondary hemorrhages should not occur following the use of diathermy. As a matter of fact there should be less likelihood of hemorrhages following diathermy than the application of heat by the older cautery methods. The operator in both cases simply attempts to produce a coagulation of the tissue and not a charring. It is when the tissues are burned to a char that secondary hemorrhages occur. The coagulation of the tissue obliterates the blood vessels, arteries as well as the veins, but does not leave open vessel lumen, which are always liable to bleed. The blanching of the tissue which follows the introduction of the heat current gives the operator a far better opportunity to judge the amount of coagulation occurring than by the old cautery method, which depended on the introduction of the heat from the outside in.

In the ambulatory treatment of internal hemorrhoids, it is possible with local anaesthesia to coagulate the hemorrhoids, one or two at a sitting, and still permit the patient to carry on. This procedure has been carried out many times in the Out-Patient Department at Washington University Medical School, both to the satisfaction of the patient and to the surgeon. Loss of time from hospitalization and the saving of money are considerable factors not to be overlooked.

Another field in which the diathermy plays a very important role is in the care of that type of prolapse frequently seen in the tabetic. Here the musculature of the bowel is not involved. The sphincter is relaxed, hemorrhoidal areas with a relaxed mucosa protrude continuously or follow each defecation, and operative procedures usually result in failure to give relief. We have been considerably gratified in a number of our cases to find that following the application of diathermy to linear areas of the protruding mass that scar contraction has so fixed the mucosa that the prolapse is prevented. Here again many of the patients were treated in the Out-Patient Department, and as the area involved was well within the mucosa no anaesthesia of any kind was required.

I believe that the multiple treatments in the tabetic have an advantage over the single operation, inasmuch as one has a better opportunity to judge of scar contraction and thereby avoid the possibility of stricture.

Diathermy is not necessary in any part of the treatment of the thrombotic hemorrhoid. It is not satisfactory in the removal of skin tabs or external hemorrhoids of any type.

Rectal Polyps

These tumors may vary in size from the size of a pea to the end of the thumb. Occasionally they grow larger. The majority grow from a small pedicle. The usual site is within the rectal ampulla, and they occasionally occur at the mucocutaneous line. Those at the lower site may be covered with a modified skin and are quite sensitive to manipulation. Those developing in the ampulla have no sensory nerve supply and can be manipulated without discomfort. For the operative removal, the lower type require an infiltration anaesthesia, whereas the upper type do not. Many types of snares have been devised for the removal of the ampullar variety through the proctoscope. A snare has been devised whereby the wire may transmit heat and coagulate the tissues as well as cut through the base. The diathermy offers either the spark or coagulation method. I believe the easier method is the destruction of the base of such tumors, thereby preventing the likelihood of recurrence, and the control of the hemorrhage. In the removal of all polypi as well as any rectal tumor, some portion of it should be saved for microscopic examination. All polypi are not benign. Through the insulated proctoscope, diathermy offers the best means for the treatment of high lying ulcers.

Anal Fissure or Ulcers

Anal fissures or ulcers usually occur at the posterior part of the rectum. The chronic type are extremely painful, are difficult to heal by palliative methods, and are prone to many recurrences. Diathermy is useful in the treatment of these lesions, but if depended upon entirely many failures will follow. Either general, spinal, or local anesthesia is absolutely necessary in any sane treatment of this condition, the most painful of all rectal lesions. Stretching of the sphincter muscle, complete destruction of the granulations that line the floor of this ulcer with actual cautery or diathermy, and the carrying out of an incision itself one-half inch beyond the margin of the ulcer into the skin proper to prevent the possibility of an undermining abscess, will invariably offer a permanent cure. Tubercular and luetic lesions will sometimes recur. The less done to the tubercular type the better. The danger in the use of diathermy

as an agent alone in the care of these lesions is that only a part of the true pathology is treated. It is necessary in order to insure uniform or good results to depend upon the three steps outlined, namely, the dilation of the sphincter, which breaks down the margin of the ulcer and exposes the rectal limits of the ulcer, the free incision into the skin margins beyond the ulcer to eliminate the undermining processes, and the destruction of the ulcer bed of granulations with diathermy, down to the sphincter muscle. It is not necessary to cut or destroy the sphincter muscle.

Papillomatous Warts

Every surgeon who has had occasion to remove papillomae about the rectal region and the vulva has been embarrassed at the rapidity with which recurrences follow. The removal with a knife is in every way unsatisfactory. The destruction of these growths with chemical irritants is likewise unsatisfactory. Large areas of skin become ulcerated, and the patient is made quite uncomfortable. The nonspecific warts always offer a formidable problem to the surgeon. The diathermy, used in conjunction with local infiltration anaesthesia, solves this problem. It has been my fortune to have had a number of such cases referred to me since diathermy has been available. Up to that time, I always felt it a misfortune not only to myself, but to the patients I had to treat, as cures were most unsatisfactory.

Patients with a number of small warty growths can be entirely relieved at one treatment. The patients are prepared in the usual procedure with soap and water, and bichloride sponge, and a local infiltration with a fine hypodermic needle. One-half of one per cent novocaine has been entirely satisfactory. Dr. Ewerhardt, of the Physiotherapy Department of Washington University Medical School, has co-operated with me in the treatment of all these patients. The regulation of the machine and the size of the spark has been altogether a matter of his selection. Without other preliminary preparation, with the patient reclining on his side and the rectum well exposed, each individual wart is quickly sparked until thoroughly blanched, and so far no patient has returned with recurrences.

It is needless to say that the destruction should not be carried down to the skin as this will result in open ulcers, which will delay the healing and may result in an annoying infection and cause the patient considerable pain. Three of our patients have had such a large number of papilloma surrounding the rectum that it was necessary to divide the treatment into several periods, at week intervals. Even in these extensive cases very little discomfort was noted. The papilloma are found to invade the mucocutaneous area and sometimes almost obliterate the rectal lumen, but stop abruptly at the mucocutaneous line. The relief of this one lesion which so far has been so very discouraging, places diathermy as a standard which eliminates all other types of treatment as unnecessary.

Carcinoma of the Rectum

Carcinoma of the rectum is rarely diagnosed until the bleeding has so alarmed the patient that he comes for medical relief. Many cases bleed for months and on account of the absence of pain the patient disregards this warning and only applies for medical aid when stricture limits the lumen of the bowel to such an extent that defecation is difficult. Many of the late cases only appear when the pains of the secondary metastasis drive him into seeking relief. Early carcinoma of the rectum is very rarely seen.

To understand the true pathology in the malignant diseases of the rectum it is necessary to have a mental picture of the lymphatic distribution of the anorectal region. Anal carcinoma is exceedingly rare, is painful, and metastasizes both up along the bowel and to the inguinal regions. The distribution of metastasis in the ampulla which comprises at least 65 per cent of all malignant growths in the large bowel, metastasize up the bowel along the lymphatics of the supporting muscles and sometimes find early growth in the liver. No one is able to determine from the size, distribution, or thickness of the malignant tumor in the rectum as to the extent of the lymphatic involvement. Small tumors which are thought to be early tumors may have extensive metastasis, whereas the larger growth may show none.

As the result of past experiences in the hands of master surgeons no type of operation has survived that does not consist in the removal of the entire rectum with its lymphatic bearing chains. Excision of the growth has proved disastrous. Resection of a cuff to include the malignant area with end-to-end anastomosis offers operative recovery but

almost sure recurrence. Operation of all types whereby an attempt is made to save the anal sphincter have been ruled out as unsatisfactory in all surgical clinics. The local destruction of the tumor with any form of heat, chemical injection, or what not is misleading and is a dangerous procedure to recommend inasmuch as no one can determine the extent of the lymphatic involvement in the smallest type lesion. Therefore diathermy is a dangerous procedure in the destruction of early and small carcinomas of the rectum and anus.

Inoperable carcinoma receives the greatest relief by colotomy and the judicious use of diathermy. If colotomy is refused diathermy frequently gives relief, and the marked shrinking of the tumor controls bleeding, and reduces the amount of mucous, thereby alleviating the distressful frequent bowel movements, that is perhaps the one greatest distressing factor in these late cases. I have had occasion to operate upon a patient who had received diathermy for carcinoma of the rectum for over a period of two years. Apparently the tumor had been replaced by scar tissue and there was considerable hope that the patient had been cured. On account of sudden distressing pain in the lower abdomen an exploratory operation was advised. Although the local carcinoma in the rectum appeared to have been destroyed the entire area about the base of the bowel was involved in a large firm mass. There were many nodules in the liver. The destruction of too large an area of the growth at one sitting may lead to secondary hemorrhages. The tumor mass can be attacked both by sparking and coagulation. With the judicious use of diathermy it is possible to give great relief for a period of two or three years, and enables the patient to carry on his routine and fill his place in society, in all inoperable types of carcinoma of the rectum, whereas otherwise his existence is a miserable one.

Conclusions

Diathermy in the form of heat with sparking and the coagulation needle have found a very definite field in the treatment of rectal lesions. The treatment by heat through the application of diathermy has purposely been omitted in this paper. Neither is any attempt made to discuss the technical side relative to the operating of the mechanical side of the treatment.

I wish to emphasize that diathermy is frequently held in disrepute because unjustifiable claims have been made for it by salesmen who have no knowledge of the pathology or treatment for which they make unlimited claims for cures.

DIATHERMY OF THE RECTUM AND PELVIC COLON*

HORACE W. SOPER, M.D.
ST. LOUIS, MO.

Surgical diathermy has been developed to such an extent that it is largely used by the urologist, general surgeon and gynecologist. It does not appear to have been used much in the treatment of rectal growths. My interest in the subject began about four years ago when I employed it for the removal of rectal polypi. Later on I used it to check hemorrhage from inoperable and recurrent cancer of the rectum. Finally, I destroyed small early carcinomas by diathermy and used it on larger growths in more advanced cases regarded as inoperable because of the patient's poor physical condition. I also used it successfully in tuberculous ulcer of the rectum.

The rectum is an ideal field for the employment of electrocoagulation. It is devoid of sensory nerves excepting in the anal canal; above this region no anesthetic is required. Moreover, it is open to inspection and repeated treatments.

The major advantages of surgical diathermy may be summed up as follows: Tissues are coagulated to any desired depth; the blood and lymph vessels are sealed, lessening the danger of metastasis in malignancy; it leaves a flexible elastic scar with little or no tendency to contraction. In this respect it is far superior to radium with its resulting infiltration

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and connective tissue formation. We see many cases of rectal stricture following the use of radium in gynecology. The eschar that forms after diathermy treatment is characteristic in appearance. It is grayish-white in color and forms a protective layer under which new granulation tissue is forming. It requires about three weeks' time for the eschar to become detached. I use the bipolar method with a spark strong enough to char the tissue quickly. One treatment suffices for a small growth or ulcer. The larger growths are attacked gradually, only a small area being sparked at the first treatment. If a large piece of tissue is destroyed at one time the patient may experience a severe reaction, probably from the rapid absorption of toxin.

The technic is briefly as follows: In growths and ulcers in the anal canal a 10 per cent solution of cocain is introduced on a small cotton applicator and allowed to remain for five to ten minutes. If the fissure or ulcer is deep and indurated a 1 per cent solution of novocain should be injected under its base.

Growths and lesions in the ampulla recti and pelvic colon require no anesthetic. The patient is placed in the knee-chest posture and thin fecal matter, blood and pus removed by means of Gray's suction pump. A specially constructed hard rubber proctoscope is then introduced and the area sparked with a small pointed electrode. The resulting vapor and secretion is removed by the suction apparatus and more tissue destroyed as desired. In large, soft growths the suction apparatus may be used as a sort of curet to break up small masses and remove them from the field.

Polypi

The ordinary small, pedunculated mucous polyp is best removed by the snare or guillotine. The polyp that presents a roughening or cauliflower-like projection at its apex should be destroyed by monopolar diathermy. The non-pedunculated polyp should be sparked by the bipolar method thus assuring deeper penetration beyond the base. This is particularly true of those nodular polyps that so frequently develop in cases of ulcerative colitis. One of our patients made a good recovery from a severe, long-continued ulcerative colitis, leaving in its wake twelve nodules from pea to hazelnut size in the ampulla recti. Bipolar electrocoagulation removed them completely leaving little scar tissue.

A physician, aged 73, had polyposis beginning just above the internal sphincter and extending up into the pelvic colon ten inches from the anus. Twelve large polyps were destroyed by bipolar diathermy. Four of them showed evidence of carcinomatous degeneration. Biopsy revealed adenocarcinoma. There has been no recurrence of the growths three and one-half years after removal.

A lawyer, aged 47, had an adenocarcinoma of the rectosigmoid junction resected at the Mayo Clinic by Dr. E. Starr Judd, in October, 1925. In January, 1926, a bunch of small hard nodular polyps formed at the suture line. They were destroyed by diathermy without recurrence.

Papillomata

The true papillomata of the rectum rarely if ever develop into carcinoma. They grow rapidly and frequently fill the ampulla. They melt away quickly under the diathermy spark. Care must be exercised in the beginning of treatment. One of our patients, aged 67, suffering from papilloma and severe secondary anemia, succumbed soon after the first sparking. A reaction had followed ushered in by chill and fever. One should begin very gradually and spark but a small area; later the patient develops a tolerance and larger areas may be attacked. These growths exhibit a strong tendency to recur and the patient must be kept under observation for months afterward. One patient required a full year of treatment for recurrences but has been perfectly clear for over two years.

Carcinoma

Adenocarcinoma is by far the most frequent growth encountered in the rectum and pelvic colon. It usually begins in the mucosa and projects into the lumen of the gut. Eight such growths have been destroyed by diathermy without recurrences in the past three years. A diabetic woman, aged 52, presented a hard nodular mass the size of an almond three inches from the anal margin. She absolutely refused surgery, and diathermy was employed. Just before sparking, a fragment was removed and section revealed adenocarcinoma. Four months later a polypoid recurrence was found in the scar and sparked. The patient was examined again recently (four years after diathermy treatment) and a smooth, small depression marked the site of the growth. Diathermy is far preferable to sur-

gery in this early type of cancer. In later growths that have involved the wall of the bowel, surgery is decidedly indicated. We have treated this type in patients in whom a Kraske operation was contraindicated because of debility incident to old age and organic disease. In one such patient the growth was far advanced, the size of a large lemon, attached by a broad base to the sacral promontory. It was finally destroyed by repeated sparkings. A rough scar tissue formed which was coagulated as deeply as possible. Ultimately a small depressed scar was secured which is located well beyond the wall of the bowel. Recurrence and metastasis may of course recur, but this patient has made a good recovery from his anemia, regained his weight and is in good general condition.

The annular type of growth should not be attacked by diathermy. If inoperable a colostomy is preferable.

Care must be exercised to prevent hemorrhage in large growths. It is advisable to spark but one area at a time and go down to the base each time. Swabbing with adrenalin before sparking is a great aid in defining the field.

Tuberculous Ulcer

Simple ulcers heal very quickly after treatment by monopolar diathermy. The tuberculous ulcer involving the anal canal responds well to the bipolar method. Considerable painful reaction may follow and the patient should be kept in bed. A patient, aged 65, presented three large tuberculous ulcers five inches from the anal canal. One ulcer was about one inch in diameter and was much indurated, producing a partial stenosis of the gut. They required a series of treatments but ultimately healed completely with restoration of the lumen of the bowel.

Conclusions

Diathermy is the treatment of choice in precancerous polyps, early cancer that projects into the lumen of the gut, and in simple and tuberculous ulcers of the rectum and pelvic colon. In later inoperable cancer, the visible growth may be destroyed and bleeding checked.

Discussion

Dr. Warren R. Rainey (St. Louis, Mo.): In displaying instruments, Dr. Soper brought out a point I just mentioned, which I think rather important; that is, in coagulation, never produce a scar. That is a thing I brought out in my paper on hemorrhoids. I have had people ask me so many times about secondary hemorrhages in the treatment of hemorrhoids. Secondary hemorrhages occur with diathermy or with old-fashioned cautery, if you destroy the tissue. Where you simply produce a coagulation of tissue, you have a large coagulated mass. Dr. Soper specified that the mass will probably be there two or three weeks before it comes away. By that time the underlying tissue and the blood vessels are sealed over and there is no danger of hemorrhage. It is where you destroy the tissue and the entire thing breaks off at one time, or two or three days later, or five days later, that the secondary hemorrhages take place. Dr. Soper and I have always had a very pleasant and heated discussion on early carcinoma of the rectum. We always agree and disagree, and with much pleasure to both of us.

Chairman Ewerhardt: I should like to hear a little bit about that.

Dr. Rainey: I don't see how one can say when he has an early carcinoma of the rectum, whether or not it is still within the mucosa or whether there may not be some more underlying involvement. If there is underlying involvement, you have lost the only chance that the patient has for an operative recovery. Very few cases of early carcinoma come to us for operation. If they would the mortality would be greatly reduced. There are more cases that we operate on for carcinoma of the rectum that die in two to three years than there are cases that get well, because there are so few that come early.

I don't know how we can specify which is the small early carcinoma that is not invaded and the one that is. I presume that in the hands of Dr. Soper he may be able to form such an estimate. I believe it would be a dangerous thing for the profession at large and men who only see a rectal carcinoma once in a few years to offer such an opinion without the aid of the laboratory. I believe the problem is too serious for the man who is not an expert, you might say, to pass judgment on these things. It is too delicate a situation at the present time to give to the profession. The work is pioneer work on Dr. Soper's part. In these cases that he has had, some of them have come to him after they were inoperable for one cause or another, probably for a personal refusal to have an operation. His further studies will materially add to our statistics. It is going to give us some valuable information as to whether we can treat that earlier type. So far, on the basis of all past experience of any type in surgical operation, other than complete removal of the rectum, I am afraid we are going to get into trouble and our patients are going to have recurrences that would not justify the procedure taken over a large number of patients.

Dr. Horace W. Soper (St. Louis, Mo.): Mr. Chairman, many people in my office think, when I discuss this problem as a rectal man that I am thinking of the anal canal as the rectum, in-

stead of the much longer area, about four or five inches. As a surgeon one should first understand the normal anatomy and its deviations. In introducing new methods into rectal surgery, one should first have a theoretical appreciation of its possibilities. Surgical diathermy has its limitations here as in other fields. At the same time its usefulness in this field has hardly been exploited. It has a future in rectal surgery, particularly when used by competent and oriented specialists. I consider diathermy the best method for removing early cancer of the rectum.

This work of mine on this subject is just twenty-two years old. In 1908 I made it a rule for every patient who went through our clinic to have a sigmoidoscopy; no matter what the complaint was, each patient was put through an examination. We now have 15,000 patients who have had sigmoidoscopy. Thus, we have had a chance to see some early cancers, pre-cancerous polyps and so on, that have been symptomless.

Dr. Rainey says, of course, a rectal man to whom these cases are referred, sees them too late, i. e., after symptoms are produced, after it is forced upon the physician's mind something serious might be there. Such cases are referred to the rectal man and nearly always it is too late. So I have always made a plea for the internist when he makes his examination to look into this blind area. How often the whole body is gone over and yet nothing is done about this area. It is so accessible, so easy to look into in a routine way. That is the plea I have made to gastroenterologists, to proctologists, to the internists of the country—look into that place in the preliminary examination.

I have participated in all the progress that has taken place in surgery of the rectum long before I knew anything about diathermy. I see some of those patients now and think of them at times with a troubled conscience. They have recovered from early operation for cancer with the Kraske, with the mutilation, with colostomy, but with an incontinent sphincter. Then I see the advance in diathermy and what I can do now and what I had to do then. I went through the radium stage of surgery. We were very enthusiastic about radium; we used radium. Terrific contraction resulted, indurations, closing up of the lumen of the bowel, colostomy. You don't know what you are doing with radium in those cases. You don't know how extensive that eschar will be, you can't control it. You can't control radium. You can control diathermy. You can spark just what you want to, see what you have done and then stop or proceed further. So don't blame me for being enthusiastic about diathermy.

Chairman Ewerhardt: Dr. Soper, I can't express how great the pleasure to me has been to be able to listen to these papers.

Fifteen years ago when we started our clinic at the university, and for the next succeeding five or six or seven years, I was regarded as a queer character by my friends in the medical field because I was doing physiotherapy. I remember I had the very first diathermy machine in St. Louis and I looked at that machine for one year off and on. I would try something and then I would go away. For one year I sort of played with it and I never really became acquainted with it until the end of the first year. When I began to talk about diathermy to my friends, they said, "Well, he is getting worse. We used to think he was a pretty nice fellow and had some sense, but he is drifting over, drifting down in the quack class."

So it has gone on. What do I see today? I see Dr. Soper making the statements you have heard. I see operations with the diathermy surgical knife. Dr. Rainey comes along and he operates on the rectum. The gynecologists are enthused about medical diathermy in production of heat. I am almost tempted to write a book on the subject of what has happened in St. Louis in the last ten years, but I don't have the literary skill. To me it has been a great satisfaction. At least they don't look upon me with such a degree of question and wanting to refer me to a neurologist.

Dr. A. L. Stabler (Birmingham, Ala.): I should like to ask a question on what Dr. Soper said about removal of growths. Would he remove anal polyps by diathermy, or papillae?

On the question in Dr. Rainey's paper of prolapse or relaxed sphincter, I would like for him to tell us the technic of his diathermy, surgical or medical, and to what extent he coagulates or dries out this tissue. Also, would he accommodate an internal and external hemorrhoid, using diathermy on the internal hemorrhoid, relaxed skin tab, and for an old external hemorrhoid would he join that outside with surgical removal?

Dr. Horace W. Soper (St. Louis, Mo.): With a small mucoid polyp, I would snip it off up in the rectum. When you come to hemorrhoids here and the fibrous polyp and all that sort of thing, I always leave that to my surgical friend.

Dr. Stabler: You don't bother a polyp in the anus?

Dr. Soper: No, I never tackle that. I leave those to my surgical friends. My experience is up here, higher up in the ampulla rectum, up in the rectal-sigmoid junction. I related a case of a physician (I am sorry he is out of town or he would have been here today to tell you about it) where a spark just could barely reach the last one that I could see with this. I sparked the last one high up, ten inches from the anal margin. So that is my answer to that.

If I see a polyp along here, I spark it and it is done. Dr. Rainey will answer the question about the anus.

Dr. Warren R. Rainey (St. Louis, Mo.): There are really more of the papilla type of polypus occurring in the anal canal than one supposes. I always felt it was such a simple procedure to snip them off. It gives you the tissue for pathological examination, and then you can spark the base very quickly with your diathermy. That will coagulate enough to prevent hemorrhage.

About the tabetic prolapse; about three years ago I noted a number of patients with a certain

relaxation of the sphincter and subsequent falling down, dropping down of the mucosa. The symptoms were so constant that in following them up I invariably found they had been referred from a neurological clinic, that they were tabetics. I would see cases that had not been to the neurological clinic, first seeing the rectum without any symptoms whatever. I would be so impressed with their similarity to these other cases, that I in my own mind made a diagnosis of tabes and sent them to the neurological clinic and had it confirmed. I have done that many times now.

Then the question came from the neurologist, "What can you do for these people to relieve this prolapsus?"

Any attempt at a large surgical procedure where you resect a cuff or try to take out a segment of the bowel often is accompanied with disastrous results due to this prolasping area. The tissues are not particularly healthy tissues, they do not heal well. Sometimes the whole suture line gives way. We found in the outpatient department, first, that we could take hold of the internal hemorrhoids without any anesthetic, put a clamp right on them, with no pain. I thought at first that was only found in the tabetic rectum. I have found out since then that most internal hemorrhoids that prolapse can be handled without anesthetic; you can put a clamp right across them without pain. The patient will let you know very quickly if you get over the subcutaneous line. We would draw them down and after drawing down the mass, take the most prominent first. We would draw it down within the grasp of a large hemostate and very gently crush that tissue and coagulate by introducing our needle along in the mass of the hemorhhoid, the prolapsing mass within the grasp of the forcep, and start our coagulation. We would carry that on until the tissue was blanched white and then stop.

We sent these patients home. None of them had any bad results, no secondary hemorrhages. One man had to go a distance of some twenty miles on a street car after each treatment and didn't complain of discomfort or any distress.

Then we would attack the second mass. At the end of the week we attacked the second largest projecting mass, and in that way we would carry on one, two, three and sometimes four treatments. The thing that pleased us about that was that on the principle of the whole linear scar that was so often attempted in surgery of prolapsus, we would get fixation of the mucosa so it didn't come down any more. We still had the relaxed sphincter. I don't know that anything could be done for that. We can fix the mucosa above; the muscularis is still up. The mucosa protrudes and drops down and becomes boggy and edematous. We could fix the mucosa so it would remain fixed and would not drop down through the skin.

I would hesitate to do all of this at one sitting if a patient is in the hospital, on account of the weak condition of the patient. In my early experiences I didn't know whether I could control the amount of scar contraction.

I have come definitely to the conclusion, not to do anything radical. It would be far better to resort to the simple procedure (without anesthetic) of a multiple stage operation rather than trying to do it in one sitting which might result in a sloughing process or might result in an overwhelming toxemia to a man who is pretty sick.

Your other question was about coagulating internal hemorrhoids and finishing the external ones with surgery. In the treatment of hemorrhoids with the cautery, one sees the hemorrhoidal mass brought down and the entire mass grasped in the clamp. Sometimes that clamp extends clear out into the true skin. That results in the complete destruction of that skin as you could expect, and the mucocutaneous tissue is destroyed. That tissue does not regenerate like the mucosa, and it leaves large open ulcers, radiating around the rectum. Those ulcers heal very slowly and throughout the post-operative course they are extremely painful. Any operation for hemorrhoids that are purely internal, where the tissue can be grasped in a clamp and the coagulation, whether it be by application of heat or whether it be by application through the diathermy needle, if it is above this mucocutaneous line, will be such that the patient is going to have a very easy convalescence; and on the fourth day when their bowels move, or the third day, or fifth day, as you choose to make it, they will have a comfortable bowel movement and the convalescence will be easy. Whereas, if you extend the destruction out into the skin, infection is certain to take place. The lack of resistance in the skin always produces infection, and the convalescence is greatly lengthened and is extremely painful.

The same principles that have been worked out for the whole coagulation with the actual cautery still holds good for the use of diathermy. It is far better to take the internal portion of the hemorrhoid, destroy it with the diathermy, and then by simple plastic operation remove the tab by nipping off, or if there is an external hemorrhoid that extends down from the point of the internal hemorrhoid, remove that very carefully without pulling it out and then suture that with a 000 catgut, interrupted sutures, and quit.

I think with that combination the patient's wound heals much more readily and the post-operative course, which is so very important in rectal work, is better. There is absence of pain practically. I think we pretty nearly approach it by that type of procedure, more so than by any other one. Does that answer your question?

Dr. Roy W. Fouts (Omaha, Nebr.): Mr. Chairman, I should like to express my appreciation to both Dr. Soper and Dr. Rainey for their papers, and also my satisfaction at knowing that men of their caliber and connection are appreciating the value of this form of treatment.

I belong to the class the chairman mentioned a while ago, having started my practice with the diathermy, in 1916. Simultaneously, my friends

in higher circles began to look sidewise as if there was another man gone bad. I gradually have observed a more tolerant attiude from those who were the first to criticize. I have even observed them in more recent times advocating surgical diathermy with the enthusiasm associated with experience. It makes one happy to have one's opinions vindicated by those from whom one craves respect.

We appreciate the fact you have contributed to this problem. No doubt you are already acquainted with the high standards of this organization. Every man who belongs to the American Congress of Physical Therapy is a member of the American Medical Association. We stand for ideals that are highest in Physical Therapy, my purpose, however, is not to laud the progress or ideals of this Congress but rather to call attention to the need of a more common terminology in relation to discussions of the action of surgical diathermy.

I would make a plea along this line: I have noticed quite a confusion of terms with reference to electrocoagulation, fulguration, desiccation, diathermy, and so on. Gentlemen, we should all agree upon a definite terminology when we attempt to express our ideas regarding the action of surgical diathermy. According to its effect, diathermy is either physiologic or destructive in action. Surgical diathermy is either electrocoagulating or desiccating in effect. You spoke particularly of desiccation and yet you said "sparking" and "diathermy." Let us express ourselves in the proper terms. I offer this as a friendly criticism.

I believe that any operation or any procedure where the lumen of any viscus is to be preserved should be done by surgical diathermy. I believe that it is the method of choice because it leaves a soft, pliable scar, with excellent healing of the underlying tissue.

TRAUMATIC ARTHRITIS *†

J. ALBERT KEY, M.D.

ST. LOUIS

Traumatic arthritis is an inflammatory condition which is the result of injury to the involved joint. It is one of the most frequent causes of prolonged disability after injuries and often transforms a young able-bodied man into a permanent cripple who is handicapped by the pain and disability in the involved joint. Consequently, traumatic arthritis is of great economic importance as well as of considerable scientific interest. Yet the subject is seldom mentioned in medical literature and we know relatively little about it.

Pathologically, traumatic arthritis resembles the condition which is variously called hypertrophic, degenerative, or osteoarthritis and is characterized by degeneration of the articular cartilage, fibrosis of the joint capsule, the production of new bone and cartilage around the articular margins, and hypertrophy of the synovial membrane. It differs from the ordinary hypertrophic arthritis in that the arthritis involves only the joint which has been subjected to injury, and in that it can usually be ascribed to a definite cause. As a rule, it is possible from an examination of the joint and a study of the x-rays to determine the nature of the cause.

The diagnosis of traumatic arthritis can, as a rule, be made with relatively little difficulty as the condition is obvious to the patient and to the physician. Characteristically one obtains a history of a joint injury which was followed by pain and disability in the involved joint. This pain and disability is increased after use and relieved by rest. An analysis of the original trauma will usually reveal a definite cause for the arthritis. The diagnosis of traumatic arthritis is strengthened by the fact that the patient, as a rule, is not troubled with any other joints and by the x-ray findings and physical examination which show the pathological condition in the involved joint. On physical examination it will be found that the joint is restricted in motion, that there is pain at the limitations of motion and on weight bearing, and in large joints there will usually be more or less crepitus on motion. On palpation there will be no local heat and there may or may not be tenderness and there may or may not be demonstrable synovial thickening, excess fluid in the joint, or bony deformity. The x-ray may show the bone pathology.

From a study of a series of clinical cases

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†From the Shriners' Hospital for Crippled Children and the Department of Surgery of Washington University, St. Louis, Mo.

we find that traumatic arthritis may supervene after the following types of injury: (1) A single severe injury to the joint cartilage; (2) repeated mild injuries to the joint cartilage; (3) disorganization of the mechanics of the joint; (4) abnormal function in a joint on account of bony deformity so that use brings about repeated injury to the joint surface; (5) gradual deformity in a joint as a result of abnormal pressure.

Examples of this type of arthritis are frequently seen in the practice of every surgeon who deals with bone and joint injuries. A few typical ones are as follows:

The first is a trauma of the great toe joint of a woman thirty years of age, who injured this toe five years previously while jumping in a gymnasium. Since that time she had suffered constant disability in the right foot with a variable amount of pain on walking. The pain tended to be worse in damp weather and at times was quite acute. On physical examination motions at the first metacarpophalangeal joint were markedly limited, there was pain at the limitations of motion, and slight tenderness over the joint. The clinical diagnosis was hallux rigidus due to traumatic arthritis. The roentgenologist's diagnosis was gout on account of the punched out areas which can be seen in the ends of the bone. I did not think this was gout as the history was typical of traumatic arthritis. Chemical study of the blood gave no evidence of gout. I operated upon the joint, resected the proximal half of the first phalanx of the toe and remodeled the head of the metatarsal. The patient made a complete and uneventful recovery. The pathological speciman showed typical traumatic arthritis.

Instances in which the arthritis is due to repeated injuries to the joint cartilage are frequently seen in patients with old injuries of the semilunar cartilage or crucial ligaments of the knee or in patients with loose bodies in the joints. The most shining example of the last type that I have seen was the case of a man who was a demonstrator for shot gun ammunition and spent the greater part of his time at trap shoots in which he fired a shot gun several hundred times a week. This man's shoulder joint had been transformed into a large sack filled with loose bodies of cartilage and bone. At operation two hundred and forty-six loose bodies were removed from the shoulder and the joint showed moderately severe hypertrophic arthritis. In his case the frequent kicks of the shot gun against his shoulder had loosened some of the cartilage from the joint. It is probable that the loose pieces were fragmented again and again by the repeated kicks of the shot gun and that the fragments continued to grow, thus eventually producing the great number found at operation.

In the cases of cartilage and ligament injury at the knee joint the articular cartilage is injured by the loose cartilage slipping in between the bones and getting pinched, thus traumatizing the joint, or by the instability of the knee thus producing abnormal motion in the joint with consequent contusion of the articular surfaces.

Probably the most frequent cause of traumatic arthritis is the disturbance of the joint surface so that incongruities in the joint surface are produced or the bones are forced to move in abnormal directions. A very common example of this type is seen in fractures of the head or neck of the radius. Here, unless the contour of the bone is quite accurately restored, and unless the head is replaced in its normal position, traumatic arthritis occurs and soon involves the entire elbow joint.

I have in mind such a case in which the offending head of the radius was resected before the arthritis had had an opportunity to develop and now, two years after the operation, the patient has normal motion, almost normal strength, and no pain and is working as a stenographer.

A very troublesome arthritis of this type is seen in the subastragaloid joint after a fracture of the os calcis. A patient suffering from such a condition had an x-ray taken two years after the fracture. He had physiotherapeutic treatment for about a year and had then given it up, but was still disabled and could not walk any distance without pain. The offending joint was resected and a subastragaloid arthrodesis performed. This, of course, relieved his symptoms, rendered the foot stable and did not interfere with the motions at the ankle.

Another example of this type is that of a patient with a T fracture of the lower end of the femur. The fragments united poorly and the patient now has about twenty degrees of motion in the joint, suffers a great deal of

pain, and is markedly disabled. She has had physiotherapy over a period of about six months with no improvement.

The fractures of the lower leg which are permitted to unite in such a manner that the line of weight bearing in the ankle joint is disturbed are practically always followed by traumatic arthritis. A rather unusual example of arthritis due to malunion of a fracture in which the joint surface is not involved is the following one. A woman had a fracture in the upper end of the humerus which was treated with the arm at the side. The fracture was united in such a way that the shaft became adducted on the head. Consequently, when the upper end of the humerus is abducted fully, the arm is abducted only about forty-five degrees. She is unable to get the arm to the head and has a good deal of pain in the shoulder as a result of faulty mechanics in the joint following the malunion.

A type of injury which is quite frequently seen at the knee is one in which there is a fracture with downward displacement of one condyle of the tibia. Such a condition is shown in an x-ray of a man who had a very mild fracture of this character with very slight displacement. In spite of the apparent mildness of his injury traumatic arthritis developed. A year after the injury this man is still unable to go back to his job as a driver of a milk truck and he suffers considerable pain in the knee. It is questionable in this case whether the arthritis is due to the incongruity of the joint surfaces or to the faulty weight bearing due to the slight knock knee which developed after the fracture, or simply due to a contusion of the cartilage. In any event he is still drawing compensation for total disability.

One of the most puzzling facts in regard to traumatic arthritis is that we are not able to determine what joints will develop the condition and what ones will regain practically normal function even with rather marked incongruity of the surfaces or abnormal function. As an example of this I cite an example of the knee joint of a woman who was struck by an automobile, suffered severe fractures of both wrists and fractures of both knees. The x-ray showed the position in which the fragments united in the right knee. In spite of the marked deformity resulting in knock knee and incongruity of the joint surfaces, this woman, one year after the injury, has a serviceable knee which is free from pain and quite stable. The man who suffered permanent disability from a mild fracture is thirty years old and the woman who suffered very little disability from the relatively severe fracture in which the displacement of the fragments was not reduced was fifty-four years old. Consequently, it is obvious that age is not the only factor in the development of the arthritis, but it is nevertheless an important factor. Old people are more apt to develop the condition than are young ones.

From the few cases cited above it is obvious that traumatic arthritis is a condition which may be expected to arise after joint injuries. Experimentally I have shown that if a small rectangle of the articular cartilage be removed from the knee joints of rabbits a marked chronic arthritis will develop in the knees of many of these rabbits while others will return to a practically normal condition. In these experiments the arthritis occurred without fracture of the bone or injury to the ligaments of the joint. At the present time we are totally unable to say why one rabbit develops the arthritis and another does not, and the same is true in human beings. However, I believe that the arthritis represents the reaction of the joint to an injury and that the development of the arthritis is dependent upon the continued function of the joint.

The prognosis in traumatic arthritis depends upon the cause of the condition, the amount of use to which the joint is to be subjected, and whether or not the joint is a weight bearing joint and whether or not the abnormality incident to the injury can be corrected.

Treatment of Traumatic Arthritis

The treatment of traumatic arthritis may be considered under the following headings: (1) Prevention; (2) medical treatment; (3) physiotherapy; and (4) surgery.

1. Prevention: We cannot prevent all cases of traumatic arthritis because as has been shown above, occasionally the condition develops in joints in which the articular cartilage has been merely contused or in which joint fractures have healed with practically no displacement of the fragments. But these are the exception and the great majority of the cases develop in joints in which there are demonstrable mechanical derangements. Con-

sequently these cases can be prevented by insisting upon the restoration of normal alignment in fractures of the shafts of long bones and upon accurate anatomical reduction in joint fractures.

I realize that an open operation is often necessary if one is to obtain anatomical reduction in joint fractures, but I believe that here the end justifies the means. Likewise in certain fractures, especially of the head of the radius, anatomical reduction is impossible and here the offending bone can be easily spared and should be removed before the arthritis develops, because removal of the bone will not cure the arthritis after it has developed.

2. Medical Treatment: We have no reason to believe that any known medicine has any beneficial effect upon traumatic arthritis. However, we have learned that the plethoric patient beyond middle life is especially liable to develop traumatic arthritis just as they tend to develop hypertrophic arthritis. We have learned to treat these patients by putting them on a relatively low calorie diet which is low in carbohydrates and high in vitamines, and to increase their elimination by saline cathartics and sweat baths. Empirically we give them alkalies and potassium iodid. The pain can often be lessened or relieved by salicylates or cincophen and we use these freely.

If the patients have obvious foci of infection such as badly infected tonsils or teeth these should receive attention. We have no evidence that there is an infectious factor in traumatic arthritis, but I grew diptheroids and staphylococci from the material removed from the subastragaloid joint cited above.

3. Physiotherapy: The most important physiotherapeutic measure which we possess for the treatment of traumatic arthritis is rest. The value of rest in these conditions is rarely recognized because our natural tendency is to loosen up a stiff and painful joint by massage, manipulation and local heat. But after joints had failed to improve under expert treatment along these lines I have seen them markedly improved after a few weeks immobilization in a plaster of Paris cast. This is easily understood if we accept the theory stated above that the development of the arthritis is dependent upon function in the joint. It is then obvious that the arthritis cannot progress while the joint is kept at rest.

However, it is impossible to keep these joints at rest indefinitely and sometimes it is a very delicate matter to so balance the rest and graded exercises that restoration of normal or as near normal as possible function will occur in the shortest time.

In addition to the complete rest mentioned above many of these joints are benefited by supports of elastic, leather or metal, or by protection from strain such as may be accomplished by altering the shoes or correcting the posture.

The popular physiotherapeutic measures for the treatment of traumatic arthritis are local heat, massage, and manipulation. Local heat may be supplied by hot applications, radiant heat or diathermy, and massage is usually done by hand. It is true that heat and massage tend to increase the local temperature and circulation, and it is probable that they also increase the local metabolism, but it has yet to be demonstrated that increased local temperature and circulation or metabolism is beneficial to traumatic or any other kind of chronic arthritis. Likewise we have no evidence that they are harmful; consequently we may continue to use them as palliative measures because they tend to relieve the pain temporarily and are grateful to the patient. But we should not expect them to cure the arthritis.

Manipulation, on the other hand, is dangerous and if injudiciously used this form of treatment may keep a joint sore over a period of many months and result in permanent harm. It is permissible to stretch contracted tissues, but if there is much structural change this is best done by the surgeon with the patient anesthetized. What I wish to warn against is the forcible movement of joints against the power of spastic muscles which are endeavoring to protect the joint. This is not only dangerous but tends to keep the joint irritated and prolong the disability.

4. SURGERY: The surgical treatment of traumatic arthritis cannot be standardized because many cases present individual problems which must be solved. In general the cause of the arthritis should be sought and if possible it should be corrected. One of the most obvious indications is to correct the alignment of bones which have united in bad position. This can usually be done by osteotomy. Another positive indication for surgery is the

presence of chronic internal derangement of the knee due to semilunar cartilages or foreign bodies. These should be removed. Likewise an offending head of the radius should be removed early.

Ligamentous injuries present a more difficult problem because stretched or torn ligaments often tighten up if they are protected, and ligaments are difficult to replace and the new ligaments are not always satisfactory. Consequently these problems must be decided by the surgeon as they arise.

Joints also present a difficult problem. Fibrosis may be overcome by manipulation or operative lengthening of tissues and bone blocks should be excised, but irregularities in the contour of the articulating surfaces cannot be corrected by operation because the cartilage does not regenerate. Consequently each joint presents a separate problem and many of them are best left alone. Joints in which stability is important and whose motion can be dispensed with without handicapping the patient should be ankylosed by bone. Examples of these are the spine, sacro-iliac, and subastragaloid joints. Joints in which motion is of greatest importance should be remodeled or subjected to arthroplasty. Examples of these are the elbow, jaw, and metatarsophalangeal joints. The shoulder, hip, knee, and ankle joints are always debatable and the indications vary in different patients.

It has been said that "the first duty of the surgeon is to do no harm" and this is especially true in dealing with traumatic arthritis. The surgeon should remember that many of these joints will tend to quiet down under rest and graded exercises and may then remain useful over a period of many years. He should also recognize the fact that a reconstructed joint is never as good as a normal joint.

On the other hand a great deal of valuable time and effort may be wasted in futile attempts to restore function in a joint which is hopelessly damaged, and occasionally, not only is time lost, but the enthusiastic physiotherapist may be the cause of actual harm by persisting in his efforts until the arthritis has reached a stage where surgery can do little to benefit the patient.

Consequently in the treatment of traumatic arthritis the surgeon and the physiotherapist should each study the limitations of their respective fields and the surgeon should not operate unless there is a definite lesion which can be corrected by operation, but he should not hesitate to be radical when radical surgery is indicated. The physiotherapist on the other hand should not waste his own and the patient's time by futile efforts to accomplish the impossible.

Discussion

Dr. F. H. Ewerhardt (St. Louis, Mo.): I want to point out, if I may, two facts about this paper. One is its presentation from a purely surgical standpoint of the subject; and the other, its ultra conservative interpretation from the standpoint of physical therapy.

I know Dr. Key well enough to highly respect his surgical opinions. In regard to his attitude toward physiotherapy he has veiled his expressions in such generalities that one may be inclined to interpret his conservatism as a lack of experience equal to his surgical.

I want to point out one discrepancy from the physical therapy point of view, along the line of manipulation in these traumatic cases. It is a vague term. Briefly, this is what I want to say: It is unwise, as Dr. Key has said, to take hold of a limb that has been partially ankylosed and try to bend that limb against a spastic contractor. For instance, in the case of the knee, a traumatic knee, it is unwise to force the knee in flexion against a contracting quadriceps extensor, so-called passive movement, which is a misnomer and is wrong. The thing can be avoided. Trauma can be avoided by applying resistive movements instead of this voluntary manipulation. That is the point I want to bring out.

If you place your hand under the heel of the patient, with the patient lying on a table or sitting, if you please, and let the patient be assured that you are not going to bend it yourself, that whatever bending is going to take place he is going to do against your resistance, you are going to support that heel and apply a little resistance. Whatever motion can be imparted in that way is a logical degree of motion which should be allowed; that and no more.

Dr. H. C. Polmer (New Orleans, La.): To the casual observer, it would seem that the doctor's group of cases were chiefly fractures complicated with traumatic arthritis, that is to say, those who received physical therapy treatments for six months or longer. It is true that many cases in industrial practice receive long courses of physical therapy treatment. But a distinction should be drawn between proper physical therapy treatment and light or diathermy administered by a man who owns a machine. There is quite a bit of improper selection of cases for physical therapy treatment and improper selection of cases for your arthroplasties. No one would expect an intelligent physiotherapist to immediately place on electrodes or give heat to any case that came into his office. By the same token we would

not expect every case of traumatic arthritis without fracture to be placed in a plaster cast for six weeks, or immobilize the part and allow complete atrophy of your quadricepsis groups to take place.

But by the combination of the orthopedist, the industrial surgeon and the physiotherapist, with the proper selection of cases, as the doctor pointed out, we can accomplish much more and get better results. In the last analysis the problem reduces itself to an intelligent understanding of the method employed, its limitations and its possibilities. The usefulness of physiotherapy has, however, been demonstrated on the largest variety of traumatic cases in many countries during and following the World War.

Dr. Norman E. Titus (New York City, N. Y.): At a meeting in New York of the American College of Surgeons one very well known man, whose name I shall not mention, got up and spoke about the use of physical therapy in industrial cases.

When asked what physical therapy he prescribed for certain conditions, he said: "I don't know; I just send them to the department, and they give them some physical therapy over there. I don't know what they do, and I don't care what they do."

I am afraid too much physical therapy in many conditions is done in that way. I am sure that if rational physical therapy is administered that a majority of favorable results obtained in less than six months. If a case of traumatic arthritis came to our department and was not distinctly better inside of three weeks, we would stop treating the patient, because physical therapy would be just a waste of time. I think there is too much hanging onto patients, sometimes because they are compensation cases, sometimes because the patients get to like it. Too much of that is being done, not for the good of the conditions presented but for the harm that finally comes to physical therapy.

I know that in the West you people do not appreciate static electricity as we do in the East. I can frankly say that restoration of traumatic arthritis is simplicity itself with static electricity. I had a service under my personal direction for five years at the Beekman Street Hospital in New York whereat our majority of cases were acute traumatic surgery. If we could not get an acute traumatic joint better inside of two or three weeks there was something wrong. I can't go into all the details, but I can just tell you this: With acute cases we sometimes don't need to use diathermy at all; we use light, if the joint is small enough. If the condition is three or four days old, and is associated with serious exudate we use diathermy because of deep heating and absorptive effects. Then after we have caused a physiological hyperemia, we use the static current to decongest the part. In our decongestion we can get rid of a great deal of extravasated fluid and even blood. I recommend this treatment with enthusiasm based on a large experience.

I became infamous at the meeting of the American Congress of Physical Therapy two or three years ago because of the wide publicity that arose when I extolled the wonderful effects of static electricity on black eyes. Black eyes is a good example of the dramatic results that can be accomplished with this agency.

Acute synovitis with effusion is a simple matter to treat with static electricity. I don't speak from a few cases but from a background of from 400 or 500 cases. I have had many football players to take care of, with effusion in joints, and inside of a week have had them back playing football. I have hundreds of cases to prove it. That may sound like a fairy tale. It is a shame that the decongested action of static electricity is not noted more widely. It is so easy to obtain favorable results in acute injuries of joints, acute muscle injuries and sprains. They are the easiest things we do, because we can get such quick and positive results in these cases.

With old cases, especially those that have had fractures complicating them, that is quite a different story. But the acute traumatic arthritis is one of the easiest things we ever have to treat. I shall mention one case. A girl was injured in December by falling on the ice. She had a synovitis with effusion. Her doctor put her to bed for three months in a plaster cast. She came to the clinic in June on crutches, unable to extend her knee. We treated her with diathermy and static electricity. In September she had full function of the knee, no sign of any trouble in the knee. She was able to walk without crutches or any aid and go back to school (she was a school teacher) and climb up and down stairs without any trouble. She had atrophy above and below the knee-joint from disuse. That was treated with interrupted galvanism and massage.

At Christmas when she came to us at Beekman Street Hospital, on casual inspection of her two knees, you could not tell which knee had been affected. That cannot be done with anything but static electricity.

We have had hundreds of cases of acute traumatic arthritis, with or without effusion. Every one of them will react wonderfully to static electricity, far better than any other treatment; and you will get these patients back to work and get them comfortable and fully functioning in the shortest period of time. You don't do it without static.

Dr. Frank H. Walke (Shreveport, La.): With reference to traumatic arthritis, the doctor mentioned purely surgical cases. In my opinion, if you have a fracture or a break in the continuity of bone, as we say, you have purely a surgical condition to deal with rather than a problem that involves physical therapy.

If we have a highly inflammatory process of the joint due to trauma, then we are dealing directly with a traumatic arthritis. Cases in which the bone has been broken, if it has been shattered or if there are fragments of bone in the joint, such states must logically be treated surgically. If there is no change in the continuity, then we can apply our physical therapy measures and expect results.

It would be absolutely foolish to try to mobilize a joint that had a fragment or a bone block in it, or a spit cartilage with physical therapy; it can't be done. But if you take a picture of the joint and see the cartilage is smooth and rounded, if you find no bone injury apparent, then you can guarantee a good result with physical therapy. But if you find that the cartilage is destroyed, if there is a fracture, even though it is a linear fracture running into it, it must be surgery.

I am very empirical in the surgical treatment of joints. I have in the last several years not attempted to immobilize a joint for a very long period. I try to keep away from plaster if I possibly can. I think the normal function of the joint is to move. I have seen some cases, especially the elbow and shoulder, in which there were fragments of bone in the joint, that if you kept the movement active from extension to traction or flexion, those fragments would take care of themselves.

I recently had a very difficult fracture in a man who weighed about 280 pounds and was only five feet seven inches tall. His elbow, to start with, a normal one, was one that I could grasp in two fingers. He had a fracture of the olecranon, head of the radius and of one condyle. It was a type of a case that one is very loath to treat because of the handicaps of certain failure ahead of us. I did not see him until the day following the injury. There was extensive ecchymosis and swelling. The pain was great. About the only position we could put him in was to put him in bed and put his arm on a pillow and give him opiates.

Finally I started treating the part with the infra-red light, every two hours for twenty minutes, and started motion in that arm from complete extension. Passive exercise was given every two hours for twenty minutes in order to prevent mobility of the part. We started to pull it just a little bit. In two hours more, after twenty minutes of treatment, the nurse would increase the extension a little further until she got it in complete range. When it got into extension, we would come back the other way. In eight weeks the patient went back to work on a job where he had been, with practically no ankylosis. It taught me the lesson that in all cases of joint injuries not to immobilize those joints too long, and introduce motion as quickly as possible.

Dr. J. Albert Key (St. Louis, Mo.), closing: I am very glad to have heard this discussion. In the first place, I was talking about chronic arthritis which is a progressive disease and not about acute synovitis.

In regard to acute synovitis, I usually aspirate the joint and get rid of the fluids that way, either of the knee or of the tremendously swollen elboks. In some of the elbows, the tissues must be incised to prevent ischemic contracture.

I do not know anything about the decongestive action of electricity. I think it would be very interesting for someone to demonstrate a series of cases which are carefully selected, so that they can be compared, and convince the surgeons of this country that it is worth while. We have the attitude that physiotherapists ignore the fact of time and nature, and they want to ascribe all of the improvement in these joints to their physiotherapeutic methods, when we feel that these joints would have gotten well whether they had ever seen a physiotherapist or not, and in practically the same time. It has not yet been proven different; at least if it has, I do not know it.

About immobilization of fractures, I still believe immobilization is the treatment of fractures. I still believe the most efficient method of procuring immobilization is by the plaster of Paris cast. In my experience, immobilization does not cause ankylosis in a normal joint. We obtain immobilization with traction where traction is indicated.

I do wish someone would publish a large series of comparative studies with the time element included, because these acute synovitis cases get well anyway; you hasten them by aspirating. If you can hasten them just as well by physiotherapy, all right. But the question is, can you hasten them more so? Of course, no one would put a synovitis of the knee up for three months. That is unreasonable. At the same time, after you take the cast off, if there is nothing wrong with the knee, one would expect a gradual return of function whether or not physiotherapy was used.

Dr. Titus: May I just tell Dr. Key that in 1920 Dr. James N. Worcester, who is surgical director of Beekman Street Hospital, read before the New York State Medical Society and published an article on a series of 150 cases of fractures of the surgical neck of the humerus. Seventy-five cases were treated with physical therapy, and seventy-five were untreated. Without my knowledge, he collected cases from my department and never told me a word about it. He was checking up on what we were doing. It was so interesting that he wrote the paper, and he was able to show that the entire disability time of those patients treated with physical therapy was less than fifty per cent of those not treated with physical therapy. That was published, I think, in 1921 and 1922. We don't touch the fracture. We take care of the adjacent joints, because I have seen twenty-five or thirty cases of ankylosed hands that had been in casts for weeks after surgical fracture of the neck of the humerus, where they ankylosed through non-use and voluntary immobilization.

Dr. Key: I have also seen that occur when physical therapy was used. It wasn't due to the physical therapy, but it wasn't prevented by it.

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

Editor: DISRAELI KOBAK, M.D., CHICAGO

E D I T O R I A L S

THE TENTH ANNUAL SESSION OCTOBER 5, 6, 7, 8, AT OMAHA

Arrangements have already been completed for the tenth annual convention of the American Congress of Physical Therapy. Omaha is prepared to welcome you and extends a most cordial invitation to all those who are interested in scientific physical therapy. True, the Congress has had some excellent programs during the nine years of its existence, but none can in any way compare to the high standard of this year's.

Physical therapy has made rapid progress. It has passed from the hands of the enthusiasts to the specialist and the practitioner who are eager to employ rational procedures which offer improved results to the sick and wounded. A perusal of this year's program will at once convince the reader that the information which will be imparted will come from authentic sources. Men of outstanding reputation and ability have accepted invitations to address this assembly. They will give generously of their experiences and will offer every possible instruction in the newer technics.

Clinics and demonstrations will occupy three morning periods. Separate sections in medicine, surgery, and eye, ear, nose and throat will meet simultaneously. The diversity of subjects which are offered is sufficient to interest any physician or surgeon, regardless of his specialty. Ample material for the actual demonstrations and operations is being furnished by the out patient departments of Creighton University and the University of Nebraska. The cooperation of these two institutions as well as that of several local medical organizations has done much to assure the success of this tenth annual meeting.

The preliminary program has been published in the July issue of the ARCHIVES. Since then it has been necessary to make several changes and additions. These have in no way altered the general tone. On the contrary the additions have greatly improved certain places which needed slight upbuilding. Now a program is being offered

which is well balanced. It is of unusual calibre and seldom will its high standard be duplicated. The program committee considers itself extremely fortunate to have gathered together such names of prominence, such subjects of wide interest, and such clinics of practical value. The material which is being offered by local participants shows the spirit of medical men to assist in the promotion of a project for the good and welfare of their community.

It is hoped that a large attendance will take advantage of the good things which have been prepared. Every fellow of the Congress should consider it his duty to be present, to bring his technician or assistant and to invite one or more of his colleagues. Every fellow should boost his organization. Help in every way possible to make this 1931 session a huge success. If you have not already done so, send in to the central offices of the Congress the names and addresses of several of your friends or colleagues who might be interested in receiving a final program.

The Tuesday evening session is of special interest. A joint gathering with the Omaha-Douglas County Medical Society will be conducted. The scientific presentations for this particular evening are outstanding in nature. This evening meeting should attract a very large local attendance. The full cooperation of the Omaha-Douglas County Society is assured.

On Wednesday evening, October 7, the annual banquet will be held. Prominent speakers will have interesting messages for you. The ladies and guests of the Congress are welcome to attend the dinner. Some excellent entertainment will be provided by the Omaha committee on arrangements.

The technical exhibits, as usual, should prove of interest. The manufacturers will make every endeavor to display their new equipment. Improved apparatus is always necessary if one is to carry on successfully. A display such as is customary at our annual conventions will assist every physician in solving his current requirements.

Again, Omaha invites you. Don't fail us! The city has numerous places of historical interest. Its hospitals and its educational institutions rank with the best. Every detail has been attended to. Fine hotel accommodations await you. Bring several of your colleagues along. Enjoy a week, combining a good vacation with valuable study. More important — do your part to promote the cause of scientific physical therapy.

METALLIC AND SALINE-PAD ELECTRODES IN DIATHERMY

The type of electrode for use in diathermy has been a controversial problem in need of more critical interpretation. Its pivotal position as a method of temperature distribution has long been recognized. Strong partisanship has developed around this situation to the point that present-day authorities are definitely divided in regard to the one best suited for maximum heat distribution.

On the basis of its greater practicability, in America, at least, the padded variety has gradually been displaced by the flexible, metal type electrode. It has been claimed that the latter variety provokes a more even heat distribution than water-soaked electrodes. Sampson,[1] for example, has stressed the virtues of flexible metal material on the basis that they are less dangerous than the former, and that they are better and more even conductors of high frequency electricity. He believes that, "Too many variable and changeable factors are working where heavy heat currents are delivered through a water-soaked electrode and this instability makes for uncertainty at all times and positive danger at others."

Experience has taught Grover[2] that for nearly all purposes block tin and lead foil are the best material for electrodes. His objections to padded electrodes are that they "raise the resistance to conduction of high frequency currents and that their use is illogical except when because of surface conditions the bare metal cannot be made to conform to the surface contour."

On the basis of studies which had incorporated both bare and padded electrodes, Bordier[3] concluded that flexible metal electrodes were superior in their general and local heating quality. Similar sized electrodes of both varieties, placed in consecutive order over the epigastrium elicited a greater surface temperature from the bare metal variety than from the one soaked in a 10 per cent saline solution. "A current intensity as high as 5,000 milliamperes produced no apparent sensation of heat beneath the moistened electrode. . . .

The skin beneath the electrode was not even reddened. . . . Howver, on replacing the pad electrode by one of pliable tin, "local and general heating effects were observed within twenty minutes.

Turrell,[4] representing the English point of view, has presented some practical arguments in support of water-soaked padded electrodes. "I have frequently tried both methods," says Turrell, "both on patients and myself. . . . In the majority of cases, however, the interposition of the pad, well moistened with a solution of sodium chloride, the exact strength of which I do not worry about, is much to be preferred. . . . Current can be more evenly applied and the underlying surface more uniformly heated. . . . A greater current can be tolerated, and a higher amperage can be obtained with wet pads than with dry electrodes. . . . My experience is that patients almost always prefer the wet pads."

The need for more substantial information regarding both varieties of electrodes is apparent and has recently been answered by Simon,[5] and elsewhere in the present issue by Hemingway and Collins.[6] The critical attitude adopted in these studies has brought forth some very conclusive information of benefit to both sides of this controversy. Rather than diversifying the issue further, it has brought to light unappreciated values inherent in both varieties of electrode application. The reader's attention is directed to Hemingway and Collins' interpretations as exemplified by the charts on pages 520 and 521 for the striking temperature distribution resulting from diathermization with metallic and saline pad electrodes. The inverse temperature reactions observed in these illustrations is the most conclusive evidence for the continued use of both types of electrodes. According to these authors, "the maximum thermal effects are at different depths from the surface for different electrodes. A metallic electrode causes greater cutaneous than muscular heating. With the pad electrode, however, a higher increase of temperature occurs in the muscle than the superficial layer of tissue. Hence for cutaneous heating a metallic electrode is to be preferred, while for increased muscular heating with a low cutaneous temperature increase, a saline pad is desirable."

The importance of these findings are self-evident. By varying the type of electrode future workers will be able to control the physiologic action of diathermy with greater certainty.

References

1. Sampson, C. M.: *A Practice of Physiotherapy.* The C. V. Mosby Company, St. Louis. 1926.

2. Grover, Burton Baker: *High Frequency Practice* (sixth edition). The Electron Press, Kansas City, Mo. 1931.

3. Bordier: Sur la chaleur degazee par la d'arsonbalization diathermique au moyen d'electrodes spongieux; graves inconvenients de as electrodes. *Competes Rendus,* **186:**540. (1928).

4. Turrell, W. J. *Principles of Electrotherapy* (second edition). Oxford University Press, London and New York. 1929.

5. Simon, G.: The Measurement of Intravenous Temperatures. *J. Exptl. Med.,* **35:**385. (1922).

6. Hemingway, A., and Collins, D.: Temperature Distribution with Different Electrodes. *Arch. Phy. Therapy, X-Ray, Rad.,* **12:**517. (Sept.), 1931.

PAYMENT OF DUES AND SUBSCRIPTIONS

Nobody has felt the depression more than the treasury of the Congress. While no worse off than other medical organizations, ours is young and without a reserve. We do not want to be unduly severe. Nor, do we wish to press those who really haven't the cash, but we do wish to urge those who really can, but have neglected it, to pay their dues as promptly as possible. The annual meeting necessarily involves a considerable expense. The journal is an item which is being carried along on an unprofitable basis. The office must carry on — all of which means that funds must be forthcoming from some source. Dues should be paid promptly. Non-members who owe for subscriptions should remit the amount of their arrears. Subscribers to the journal who fail to pay the subscription fee, sixty days after the due date, will be dropped from the mailing list without notice. This will interrupt the regular reception of the ARCHIVES by you. We are certain you do not wish this to occur.

Please forward back dues and subscriptions at once. Assist those who are lending their efforts in your behalf without compensation to carry on without financial embarrassment and worry.

The Congress urges your cooperation in this connection and trusts that the fellows and subscribers will show their appreciation by prompt action.

PHYSICAL THERAPY CLINICS

MEDICAL ELECTRO-PLATING

J. U. GIESY, M.D.
SALT LAKE CITY, UTAH

Electro-plating today holds a definitely established place in the commercial arts. We do not, however, hear as much of its employment in the art of medicine, as it sometimes appears to me, we really should. This is a comparative statement, of course. Living tissues are not actually surfaced with a metallic coating. But let us examine the matter from the standpoint of the principle involved.

Generally speaking the process of plating is one of depositing a coating of a metallic nature upon a selected object or form, by means of an electric current passed through a plating bath—or solution of the chosen metal—in which the object to be plated is immersed.

The essential elements are therefore—first, this bath or electrolyte, in a proper container; secondly, an electrical circuit one pole of which shall be for the time being the object to be plated and the other a lead or connection so placed that the current must traverse the electrolyte to reach the plating pole; and third, a current control such as will regulate the current potential to the desired strength.

In medical work the same rule applies and the essential elements for the technic are the same, save that they are in a measure modified. Let us assume that we have an abscess to treat. The abscess walls will at once become not only the walls of the container of the electrolyte itself, but literally the plating pole as well. That is, they are the part of the tissues to be "plated," not only on the surface as in any other plating process, but to a certain extent to be *penetrated* beneath that surface by the substance held in solution in the abscess cavity or plating bath. This effect is, of course, essential in order to exert both a bactericidal and bacteria-static control upon any organisms which may have penetrated the tissues actually forming the walls of the abscess sack.

The electrolyte used in medical electroplating will be of a nature to insure a rapid depositing of the agent held in solution upon and within the tissues of the abscess wall, by that well known capacity of the galvanic current commonly spoken of as "ionization," which is actually the same quality which renders commercial plating an undisputable success. Consequently the solution used as a medical electrolyte and hence the solution with which the abscess cavity is to be filled before the treatment is undertaken, must be designed to give the best practical effect. This being a factor it must harmonize with the laws of solution and current diffusion and be of a weak concentration rather than otherwise. Experience teaches that a concentration of not to exceed two per cent is best.

The ionizing or active pole, through which the current is led into the electrolyte to bring about ionic activation, should be of a size and quality to readily enter the abscess cavity along an opening or sinus, to harmonize with the solution used, and intensify the effect desired. The plan is literally to lay down a barrage of the active ions in the abscess wall tissues, as well as to exert a destructive action upon any of the infecting organisms held in the bulk of the electrolyte after the latter has been introduced into the abscess sack.

In active practice, we use a two per cent solution of either zinc iodide or zinc sulphate. Zinc is a very powerful antiseptic, especially when ionized into infected tissues in a metallic form. Consequently it offers an excellent choice for the contained salt in our electrolyte. At times, however, it may be of advantage to employ bismuth with which the abscess cavity is filled and into which the active electrode is introduced. Bismuth being of a metallic nature, responds well to the ion-

izing action of the direct current, and will give excellent results.

The plating pole—in this case the negative, which actually activates the walls of the abscess to the reception of the zinc or bismuth ions, should be applied to the body surface in a position to insure an easy, direct current flow.

The active pole, in the sense that it is the pole which by its known action of propelling metallic ions away from its zone of contact is responsible for the laying down of the ionic bombardment on the pyogenic tissues, will, of course, be the positive. It should be inserted on an insulated staff to a depth sufficient to insure its being actually within the volume of the electrolyte, and be constructed as a general rule of molded zinc.

With our elements now all assembled and our electrolytic container, which is the abscess cavity filled with the solution chosen, we are ready to begin our work.

The negative pole is fixed in place. The positive pole is introduced, and the current is turned on to just below the patient's tolerance. This as a rule will mean a rather weak current. But the dosage should be determined by a mathematical rule which will insure the best results. This rule is the same as that applying to dosage measures of any medical galvanic current, *i. e.,* milliamperage multiplied by time.

In most of this work, two, three or exceptionally five milliamperes are about all the patient will tolerate without painful sensation and complaint. Hence to give, say thirty milliampere minutes, which is the average recommended dosage, we find that a two m. a. current should run for fifteen minutes, a three m. a. current for ten minutes and a five m. a. current for six minutes to effect the dose. Actually, I believe that the best effects are gained by using the lower amperage for the longer time. Not only is ionization more completely effected in this way, but ionic penetration I believe is greater and with a minimum of tissue trauma.

But you will say this is no more than the ionization of which we have heard now and then for years. That in effect is true. But the truth also, is that very little practical application is being made of a method capable of giving surprisingly good and at times unexpected results. For that very reason I have handled the subject as I have in presenting it to you, on the basic principles that it is no more than an application of the process of electro-plating, to the control and cure of infectious processes, such as those we so constantly meet with in practice.

Some men are using it consistently in their work. Friel of London, England, has been doing so for years. He employes it in chronic empyemas, in intractable otitis medias, and in rhinology to a large extent. And what is an empyema or an otitis media save an abscess specifically placed?

Naturally the employment of the method presupposes an opening into the abscess. But that is apt to exist, especially when the case comes to you for relief after other methods of treatment have failed. If not it is more or less readily made and, in the otitis cases, it has generally even in this day of scientific practice accomplished the fact by itself.

In an empyema, it is well to inject the cavity with lipiodol and map out the cavity with the aid of an x-ray plate first. Then fill the cavity with your electrolye—zinc iodide is the material I use. Lay the patient on a large negative moist pad. Slide your molded zinc tip into the cavity through the fistula in the chest wall. Give three to five m. a. for ten to six minutes. Repeat every three to five days.

In *otitis media* the ear itself becomes the container of the electrolyte—a zinc solution is run in through a funnel-shaped electrode, not unlike an ear speculum in appearance to which the positive lead of the machine is attached in a way to insure its projecting into the electrolyte. The negative pole is brought into contact with the neck and mastoid region, preferably, since in nearly all these old otitis cases the mastoid is in some degree involved. Two m. a. are given for fifteen minutes, or three m. a. for ten minutes, every five to seven days.

In other instances of infectious processes not of an abscess nature, the same principle of treatment can be readily modified. In fissures and fistula this is generally the case. Here the positive electrode becomes the actual ionizing agent itself, without the use of an electrolytic solution, save as in the latter condition, a bismuth paste may at times be used. Usually, however, we employ a positive pole in the shape of a flexible wire or probe which will penetrate the fistula, or of a blade shaped tip which can be laid into the

fissure. Molded zinc is the best material to use. Such an electrode is applied under a four or five milliampere current until the desired dosage is given. In the case of fissures a good indication is afforded by the tissues themselves. In these cases the current should flow until the walls of the fissure turn a paper white.

In rhinitis, rhinological and ethmoidal conditions, the place of the electrode is taken by either a nasal pack soaked in the solution and is made contact to the positive lead, or actually wrapped about a small probe electrode and introduced with a firm contact into the zone it is desired to treat. Under this attack infectious processes of the nasal areas show rapid and satisfactory progress almost from the first. Attack into the ethmoidal zone will bring about both disinfection and shrinking of the tissues in the region, resulting in the opening up of closed or partly closed respiratory channels and a better ventilation of the supra-orbital sinuses, with marked relief of cases of sinusitis which have caused immense discomfort for months or years. Here adrenalin, being an alkaloid may be also added to the solutions employed on the pack or cotton wrapped probe to increase shrinking effect.

I feel that this method of treatment may well be consistently stressed. I feel that if those who read this short exposition of some of the possibilities of the subject and will try the method outlined, they will be convinced on the basis of results. I urge the attempt upon them because I have myself employed the method for years with a great deal of satisfaction and success.

QUESTIONS AND ANSWERS

Q. Is hydrotherapy of any value in deafness?

A. James Adam (*British Medical Journal,* 1:621, April 11, 1931), reports the treatment of cases of progressive deafness of the catarrhal type by hot immersion baths with magnesium sulphate (1 pound) added to each bath. In most cases there was definite improvement in hearing, and in some relief of tinnitus. The improvement was most marked in the less chronic cases. The treatment was also used in 2 cases with Méniére's complex, both of long standing; there was some relief in one of these cases. But the author is of the opinion that in earlier cases of this condition, the treatment would be of definite value. In some of the cases of chronic catarrhal deafness all other methods tried had failed to give any relief, so the author believes the bath treatment is worthy of trial in such cases. In order to be effective the baths must cause the patients to sweat; in one case the amount of magnesium sulphate used was doubled to effect this. The baths are not indicated for elderly, weakly or cardiac patients.

Q. Is diathermy of help in endarteritis obliterans. (Buerger's Disease)?

Properly administered diathermy is of great aid in Buerger's disease. It is one of the best methods to relieve the stasis, cyanosis, and promote a better flow of blood. Under treatment the coldness of the part becomes pleasantly warm, the pain is materially relieved, and the color returns to normal. Diathermy should never be pushed here to maximum tolerance. The purpose or object should be that of developing new tributaries for the blood to circulate through the affected part. On account of the obliterating action of this disease on the vessel walls within, a compensatory action must be developed by the stimulation of collateral circulation. If the toes are involved, it is best to adapt an electrode about them, cup shaped in form, made from cellucotton moisened in warm sodium bicarbonate solution. Tin foil material is then well moulded to it and fixed by means of elastic bandage. It is better to have the cord which is connected to the electrode of lighter weight than ordinary and well supported to insure against loose contacts and accidental sparks. The in-

different electrode consisting of a bare, metal electrode is placed in the manner of a cuff about the upper third of the leg. The current or milliamperage should vary from 250 to 500, the length of each treatment to be from 20 to 40 minutes. In the beginning, treatment should be given daily and then on alternate days and lengthened according to the judgment of the physician.

The following technic has been recommended for the relief of spasm associated with this condition. Two 2x4-inch electrodes are applied 3 inches above and below the knee of the affected part, one pair on the internal portion, the other external. Each pair is laterally connected by a terminal and there by bifurcated cords to the apparatus. The treatment produces an agreeable sensation of warmth in the affected part as well as in the opposite leg. Gradually there ensues a generalized feeling of warmth, relaxation, drowsiness and disappearance of pain. The treatments are administered daily and then lengthened out according to the best judgment of the physician. The amount of current employed is between 800 to 1,000 M. A. Time of each seance is between 20 to 40 minutes. The limb should be covered during treatment.

Q. Has ultraviolet any effect on psoriasis?

Some psoriatics improve remarkably and others fail to respond under ultraviolet treatment. The reason for this is that we often fail to recognize the barrier set up by the crustated part which prevents the penetration and absorption and stimulation of the affected part. In chronic cases one should, therefore, use soothing lotions and softening emolients before applying the ultraviolet rays. The parts should be clean and free from oil before irradiation. Usually there is a gradual improvement and often a complete disappearance of the symptoms, but, unfortunately, there are many recurrences. Patients who have not had a previous attack and those in whom the onset has been rapid, respond best. In fact, in all acute cases of psoriasis, ultraviolet radiation together with salves and lotions should be used until the inflammation has subsided. To obtain favorable results one should produce a second degree reaction, locally. Thickened patches should be treated by compression methods with the water cooled lamp. The surrounding healthy parts should be well protected. Ultraviolet is of particular use in the intertriginous type of psoriasis, which responds so poorly to other measures. After the disappearance of the generalized psoriasis, general tonic ultraviolet irradiations plus ointments materially prevent relapse. The superficial, slightly infiltrated lesions naturally respond better or rather quicker than the chronic, indurated types.

Q. What is understood by roentgen sickness?

A. Pancoast (*J. A. M. A.*, **96**:1757, May 23, 1931), discusses the subject thus: "Roentgen sickness is a condition which is not thoroughly understood. Various theories have been advanced in explanation of it but none of them tell the entire story. Atmospheric conditions play an important part but even radium applications may produce similar or the same symptoms. The direct effect on the blood seems to have some influence. The annoying symptoms may be minimized by dividing therapeutic applications over a period of several days. Adequate ventilation is essential as a preventive measure. Dampness should be avoided and radiologic departments should not be located in basements. Rooms should be well ventilated. Suction exhaust ventilation is necessary for transformer and treatment rooms, and fresh air is essential in control rooms."

Q. What is the treatment of splanchnic insufficiency?

This depends upon the cause and should so be treated. Treatment should be directed toward the promotion of better vasomotor action of the peripheral and deeper centers of the affected part. The action of the heart should be thoroughly checked over and regulated accordingly. "The keynote to treatment," according to Snow ("Textbook on Physical Therapy," Vol. I. p. 497, Scientific Authors Publishing Co., New York, 1931) "is visceral drainage and toxic elimination accompanied by high colonic flushings, radiant light and heat, carbon arc treatment hydrotherapy, diathermy if the static wave current is contraindicated, ultraviolet to improve the composition of the blood and the static wave current or the wave generator or sinusoidal current in varying combinations based upon clin-

ical and pathological findings. The static wave current is applied by means of a flat metal electrode about six by eight inches in dimension placed over the liver and splanchnic area in all cases, whether of hypo- or hypertension, unless its use is contraindicated as when gall stones or cholecystitis or malignancy is present. Such treatment improves the tonicity not only of the liver but of the blood vessels of the splanchnic area. If the static current is not available the sinusoidal or wave generator current is used under the same restrictions. Mechanical vibration for the induction of spinal reflexes of contraction is applied to induce contraction of the congested organ. Splanchnoptosis calls for replacement and support. For the improvement of respiration, gymnastic exercises properly supervised by a competent instructor, who is also a physician, are helpful to overcome respiratory deficiency and special exercises may be used for ptosis."

Q. What is the treatment of prolapsed uterus?

Treatment depends upon the degree of involvement. The severer types should be treated by surgical fixation. The milder varieties may often be benefited by combining exercises in the knee chest position, sinusoidal currents to abdomen and uterus, static wave current and diathermy. The value of diathermy is to overcome the congestion that is often found associated with the condition. Recent reports indicate the value of colonic irrigation in these cases. It is a method that helps to improve the tone of the part, and to reduce the leucorrhoeic discharge associated with the condition. It is assumed that all etiologic factors have been corrected.

Q. Is diathermy of value in glaucoma?

A. Diathermy has been used in the treatment of glaucoma more or less on an experimental basis. Hollender and Cottle (*Physical Therapy in Diseases of the Eye, Ear, Nose and Throat*) in their investigations found that the lowering of intraocular tension was of a temporary nature. As the effect on the plus tension would be the determining factor, therapeutically, it cannot be said that diathermy is of any particular value in glaucoma. On the other hand, it is a matter of agreement that in those cases in which pain is present, diathermy, correctly applied, produces marked palliation. Further experimentation is necessary to settle this question finally. From the published reports there have been noted no harmful effects from the application of diathermy to the eye. This, in contradistinction to the views of a few workers who claim that the employment of diathermy for ophthalmic conditions eventually leads to opacity of the lens.

RAILROAD CERTIFICATES

If you come to the meeting at Omaha, October 5, 6, 7 and 8, and travel by rail, please be sure and obtain a convention certificate when purchasing your railroad certificate. The roads have granted a one and one-half rate basis, but in order to become effective for those attending the convention, 100 certificates must be turned in. It makes no difference how far you come from or how near you are to Omaha. Ask for a certificate when you buy your railroad ticket. Each year, more than several times the required number attend. The certificates are not asked for with the result that the reduced convention railroad rates are not secured for the benefit of those who attend the session. This works a hardship especially on those who come from distant points. Please ask for a convention certificate or a receipt when arranging your transportation, and when you register for the sessions, deposit your certificate, properly signed, with the executive secretary of the Congress.

The committee is employing every means of reminding you about the convention certificates. DON'T FORGET THEM, THIS TIME. If you bring your wife, or other members of your family, they, too, are entitled to the certificates.

CURRENT NEWS AND SCIENCE

Improved X-Ray Methods Developed at Mayo Clinic

Dr. B. R. Kirklin and Dr. H. M. Weber, of the Mayo Clinic, Rochester, Minn., have announced results of new work in the x-ray detection of disease. Dr. Kirklin's work has been on the gall bladder and Dr. Weber's on the large intestine.

The x-ray picture, as is well known, is a shadow, cast in varying density, according to whether the rays can or cannot pass through the tissues. The stomach, intestines, normal gall bladder, and their normal contents allow the rays to pass easily, and therefore do not cast good shadows on the x-ray film. Shadows of gallstones which would stop the passage of x-rays have been seen on films for many years. However, not all gallstones are satisfactorily opaque to x-rays.

The story of the development of methods for getting x-ray pictures of the gall bladder is a long record of brilliant achievement. Briefly, the method is as follows: The patient is given a harmless dye through which x-rays will not pass, and which is gathered up in the gall bladder; then pictures are taken at intervals for a number of hours.

Using this method, until recently it has been considered impossible to distinguish between the shadows of gallstones of low calcium content and papillomas, which are little wart-like growths. However, Dr. Kirklin found a number of features that were characteristic of papillomas and not of gallstones. For instance the shadows of the papillomas were in the same position on all the films, whereas the shadows of gallstones might be in different places on different films; moreover, the shadows of papillomas were not immediately at the bottom of the gall bladder, whereas the stones would be likely to be there, like marbles in the bottom of a bag. There were, also, other characteristics. Four patients on whom Dr. Kirklin made the diagnoses were operated on, and papillomas were found, as he had predicted, in all four.

The method used by Dr. Weber in taking x-ray pictures of the large intestine was developed by Dr. A. W. Fischer, in Germany, and has been used also by Dr. J. Gershon-Cohen in this country in the x-ray diagnosis of tuberculosis of the large intestine.

It has been customary, in taking x-ray pictures of the large intestine, to give the patient an enema, in which is suspended some barium, a substance through which x-rays will not pass. Thus, a shadow of the barium-filled intestine is obtained and deformities caused by disease can be seen. The method is good. However, it fails to disclose soft masses that do not cause deformity of the wall of the intestine, but merely project into its cavity.

The new method discloses such masses, including growths called polyps, in which Dr. Weber was particularly interested. The patient takes the enema, as in the old method, but expels it. Then, before the picture is taken, what might be called an air enema is given very carefully. The result is that the polyps, to the surface of which the barium has adhered, are outlined.

To detect the presence of these polyps is important, since they have a tendency to develop into cancer. Also, Dr. Kirklin expects that his discovery that papillomas of the gall bladder can be detected, will be extended to the detection of early gall bladder cancers.—*Science News Letter,* March 7, 1931.

Non-Living Matter May Learn and Remember

The ability to learn and remember is probably not confined to living organisms.

An important mathematical investigation by Dr. N. Rashevsky of the Research Laboratories of Westinghouse Electric and Manufacturing Company has shown that certain mixtures of lifeless fluid substances ought to show behavior indistinguishable from what we call memory. Properly chosen combinations of liquids will respond to repeated changes in the temperature, pressure or other conditions to which they are subjected, as if they were sensitive to their past experience and could put 2 and 2 together.

Apparently this unique behavior is possible

in a system which may come to rest in more than one position. For instance, a rectangular block may be in equilibrium when resting on any one of its faces. In addition, however, there must be a lag in the changes within the mixture itself, by which when the substance is displaced from its resting condition an appreciable time is required for recovery.

Dr. Rashevsky has actually proved that such mixtures would show Pavlov's famous conditioned reflex which is the foundation of behavioristic psychology.

It is not suggested that this is the exact physical mechanism of memory in living animals. Further, no such mixture has yet been made and tested in the laboratory, though the mathematics makes that sequel probable.

However, this is one of the most daring and well-informed attempts to handle a question of psychology and biology by the method of mathematical physics.—*Science News Letter,* March 7, 1931.

Short Waves for Cancer Irradiation

The increase in cancer incidence in Germany, according to the statistics of recent years, has had the natural result of intensifying the crusade against cancer. From the therapeutic standpoint, importance attaches to the new experiences with cancer therapy with extremely hard roentgen rays, which E. von Schubert has reported from the Frauenklinik of the University of Berlin. A survey of the irradiation methods applied at the present time to cancer of the neck of the uterus shows, with approximately identical results, extremely diverse technic. In general, one notes an increasing tendency to apply radium. The results, however, are still unsatisfactory, especially in the inoperable cases and in recurrences. The superiority of radium is recognized for purely local application; but when large areas must be irradiated the roentgen tube is preferred, especially if its action can be made to resemble that of radium. One way to accomplish this is to distribute the dosage over several days with a small dose per minute and, at the same time, a heavy total dosage; the other way is to change essentially the quality of the rays by shortening the wavelength. Until recently only a tension of about 200 kilovolts was employed; but today apparatus is being constructed that supplies a steady current of 600 kilovolts. The tubes will stand only a current of 400 kilovolts; further development is, however, possible, if it appears desirable. On this basis, an equipment has been installed in the aforementioned clinic the chief instrument of which is a half wave appparatus of 600 kilovolts that functions in accordance with the Villard system. The tubes are manufactured especially for these high tensions and are now operated regularly with 360 kilovolts. The equipment was installed in such a manner that in the treatment room there is no electrical apparatus, and so that the rays come up through the floor, the tube being placed in a chamber beneath the floor level. In a third space is the machine equipment. A system of safety devices is provided to combat the dangers arising from the high tension. The undesired roentgen irradiation is intercepted by plates of lead that line the walls of the tube chamber and that weigh several hundred pounds. The clinical experiences are still too few to risk any definite statement. The advantages of the protracted fractioned method of irradiation introduced by Coutard lies in the lessened damage to the skin by the extremely hard rays applied from a great distance, and the long continued daily irradiation (extending over several weeks), as compared with the intensive burden imposed on the skin by the single maximal dose, or the dose applied in a few days. The injuries to the skin resulting from the protracted method heal with scarcely a trace. Sielmann achieved some good results in inoperable cancers, particularly of the tongue and of the cardia. It is possible that even in supposedly inoperable cancers a cure may be brought about, or at least that far-reaching improvement may be effected.—Foreign Letters, *J. A. M. A.,* **96:** 1887, (May 30), 1930.

Universe Not Running Down

Hope that the universe is not running down and will not ultimately have the fate of a "heat death," with extinction of all its activity, was offered science by Dr. Robert A. Millikan, chairman of the Executive Council, California Institute of Technology and Nobel Prize Physicist, who delivered the principal address of the American Association for the Advancement of Science at Cleveland, as its retiring president.

After presenting his experimental evidence

that the penetrating cosmic radiations are the signals coming to earth telling of the formation out of hydrogen of helium, oxygen, silicon, iron and other common elements in the intensely cold regions in the depths of interstellar space, Dr. Millikan suggested that "It may be that hydrogen is somehow being replenished there too from the only form of energy that we know to be all the time leaking out from the stars to interstellar space, namely, radiant energy."

This formation of the fundamental building block of all matter, the hydrogen atom, out of light and heat, is not a new idea. It has been advanced speculatively in the past, as Dr. Millikan said, "To allow the Creator to be continually on His job."

Referring to the contentions of Sir James Jeans, British astronomer, that the universe is dying, Dr. Millikan said further: "If Sir James Jeans prefers to hold one view and I another on this question no one can say us nay. The one thing of which you may all be quite sure is that neither of us knows anything about it. But for the continuous building up of the common elements out of hydrogen in the depths of interstellar space the cosmic rays furnish excellent experimental evidence."

The formation of hydrogen out of heat radiation is the "missing link" that must be demonstrated in order that the whole great universe will not in a distant future run down like a spent battery. That is why the idea is so interesting to scientists.

Dr. Millikan traced ten discoveries or developments made within the past hundred years which bear upon the question of the origin and destiny of the physical elements.

1. The discovery of the equivalence of heat and work and the consequent formulation of the principle of the conservation of energy.

2. The second law of thermodynamics, which is interpreted by some as necessitating the ultimate "heat death" of the universe, classically and simply stated in the Humpty-Dumpty rhyme. This led to the mediaeval theological suggestion of a deus ex machina to initially wind up or start off this running-down universe.

3. The discovery of the facts of evolution which showed that in the biological field at least the upbuilding from lower to high forms has been continuously going on for millions upon millions of years and is presumably going on now.

4. The discovery that the dogma of the immuntable elements was definitely wrong. This came with the isolation of radium and other radioactive elements.

5. The discovery of the enormous lifetimes of the sun and stars, thousands and a half years, and the still greater lifetime of the sun and stars, thousands of times longer than the periods through which they could possibly exist as suns if they were simply hot bodies cooling off.

6. Development of evidence for the interconvertibility of mass and energy which suggested that the mass of the sun might be converted into radiant heat.

7. The discovery that all elements are built up out of hydrogen. This postponed the heat death of the universe at least until all the hydrogen in the universe had been converted into the heavier elements.

8. Astronomers chafing under the time limitation thus imposed suggested that complete annihilation of positive and negative electrons within the atomic nucleus can take place, again extending the possible time span of this universe, this time a hundred fold.

9. Measurements by Dr. F. W. Aston, English physicist, on relative masses of atoms which supported Einstein's formula for the relation between mass and energy, showed atom building out of hydrogen and helium to be one of the two possible sources of energy other than the sun and the intensity of radiations that would be produced by atom building out of hydrogen and helium.

10. Discovery of the cosmic radiations which are evidences of the continuous building of the heavier elements out of hydrogen. —*Science News Letter,* January 3, 1931.

THE STUDENT'S LIBRARY

BOOK REVIEWS

PRACTICAL RADIATION THERAPY. By *Ira I. Kaplan,* B.S., M.D., Director, Division of Cancer, Department of Hospitals, New York City; Attending Radiation Therapist, Bellevue Hospital, with a special chapter on, APPLIED X-RAY PHYSICS. By *Carl B. Braestrup,* B.Sc., P.E., Radiation Physicist, Division of Cancer, Department of Hospitals, Physicist to Mt. Sinai Hospital, New York City. Pp. 354 with 227 illustrations. Cloth, $6.00. Philadelphia and London: W. B. Saunders Company. 1931.

The demand for a practical text on the theory and practice of radiation therapy has been answered by the author in the presentation of the foregoing volume. Therein the various phases of radiation are discussed in a succinct and comprehensive manner. The material is presented in that clear and simple style attractive to both the novice and those better oriented with its discipline. It is obvious even to those less experienced with the subject that the author has drawn upon a large experience to enable him to introduce the many pertinent and important suggestions frequently found interspersed in the many pages. We have in mind such chapters as "The nursing care of patients with malignant conditions," "Accidents and radiation burns," "Unit radiation therapy for a general hospital," "Servicable prescriptions," etc.

One feels that the author has dipped his pen in the well of actual experience exemplified by remarks as the following: "The nurse must engender in the patient and his surroundings a general attitude of hopefulness. Healing following radiation therapy requires a long period of time, and the patient must be helped to keep up his courage and patience. The nurse must remember she is the doctor's aid, that he trusts her, and she must work with him for the benefit of the patient. Her effort proffered in the spirit of willingness will find full reward in the satisfying knowledge of the good she has really accomplished." No other type of patient swings more easily between depression and hopefulness than the one suffering from malignancy. No other type is more ready to adventure among the therapeutics of the charlatan than he; and no one is more in need of the uplifting cheer and the optimism of intelligent nursing care. The foregoing comment is therefore an index of the many practical suggestions incorporated throughout the text.

That the treatise is a well rounded contribution is indicated from its contents. It discusses the historical developments of radiation. It defines the action of x-ray and radium, its production and emanation, its physical properties and dosage. The major portion of the book, however, deals with the practical application of the foregoing agents to various benign and malignant conditions of the body. The text is richly interspersed with many half-tone illustrations, charts and figures, facts which materially aid in the better understanding of the subject matter under discussion.

Unfortunately, the author has not maintained the same high standard of accuracy and detail when he discusses endothermy. Here he has obviously sacrificed detail for brevity. In justice to the subject, it should either have been discussed with the detail deserving of its importance, or omitted from the text. No beginner could possibly draw much inspiration or conviction from such meager paragraphs (three lines) as that which professes to deal with "hemorrhoids" or "Condylomata and Veruca." It is to be hoped that future editions will devote proper space to this new form of surgery—a surgery with advantages that should particularly appeal and be more universally adopted by all radiologists. The many fine points incorporated in this text, are however, so outstanding that it should become the popular reference text for all radiologists. The book is highly recommended.

Comment sont traites LES RHUMATISANTS CHRONIQUES dans le Service Central de Physiotherapie de Hotel-Dieu de Paris. By *H. Dausset, L. H. Dejust, A. Chenilleau, L. Brage-Gillot.* Pp. 64 with illustrations. Paper. Price, 12 francs. Paris: L'Expansion Scientifique Francaise. 1931.

This small brochure contains an interesting exposition of the various methods employed in one of the largest hospitals in Paris for the treatment of chronic arthritis—namely the Central Service for Physiotherapy at the Hotel Dieu. Treatment is dependent upon the diagnosis and classification of the type of arthritis present and varies according to the nature of the involvement and the etiologic background. Both medicinal and physical therapy are freely inter-mixed in the management of each patient.

The medicinals are prescribed for oral, intramuscular, or by inunction administration. They include various forms of iodides, thiopropanol sulphonate (0.05 to 0.10 c.g.m., intramuscularly) small doses of sulphur, injections of oxyradon, salicylates, irradiated ergosterol, vaccine protein — opotherapy, and special diets. Treatment is individualized to the need of each patient and is directed by a group of physicians thoroughly experienced in all of the methods in current use.

Physical agents are simultaneously utilized with medicinal therapy for the purpose of provoking sedative action through the influence of thermogenetic means. Consideration is, therefore, given to measures that modify the local or general metabolism of the individual. The measures most utilized are

infrared, radiant light, cabinet baths with carbon lamps, mercury vapor and carbon arc lamps, hot air baths, paraffin baths, diathermy, hydrotherapy, mechano- and kineso-therapy, massage, corrective exercise and electrogymnastics, electrolysis and x-ray. Emanation therapy in the form of radioactive substance is employed for the purpose of influencing the uric acid content of the blood. *"Le principal effet de ces injections c'est de faire retomber à la normale la quantitè d'acide urique contenue dans le sang."* This is introduced through inhalation or injection. Excellent results are, for example, claimed for Thorium (per injection) and for radioactive baths.

The citation of case reports at the end of this volume offers convincing proof of the combining value of physical and medicinal therapy for the alleviation of chronic arthritis. Rheumatism associated with menopause appears to be successfully influenced with radiant light baths and medicinals. Fourteen case reports have been purposely selected as particular examples of the value of the mixed therapy described above. The dis-similarity and the chronicity of some of these cases are pointed out in each instance in order to demonstrate the value of the particular therapy advocated in these pages. A wealth of practical information has been packed into the confines of this small volume.

The crippling effect of chronic arthritis is now so well recognized that it behooves the medical profession to adopt any new method that offers the large amount of data as do the authors in support of their claims for physiotherapy. The facts are presented in a concise and clear manner without padding and is abbreviated to the point of outline style. The book is highly recommended to all interested in the subject.

PERNICIOUS ANEMIA. By *Frank A. Evans,* M.D. Cloth. Pp. 170. Price, $2.50. Baltimore: The Williams & Wilkins Company. 1926.

Apologies are hereby offered to author and publisher for the belated review of this work. The removal of the editorial office from Omaha was responsible in the inadvertent misplacement of this and several other valuable contributions.

The lapse of several years since its publication has seen an awakened interest in pernicious anemia. Although its therapeutics have since then been modified on account of the new appreciation for the potency of liver in this disease, the book with this exception is as clear and comprehensive a discussion of the problem as is to be found in the best text. Every phase of the problem is critically reviewed. The author has generously drawn his information from selected publications, reference to which the reader is invited in the appended bibliography. According to the author, an attempt has been made to draw the clinical picture of pernicious anemia as understood at present, to reconsider treatment and to discuss the more promising lines of study so far made on the etiology.

The subject is presented in the classical outline form of medical writing, beginning with "definitions" and ending with a discussion of "prognosis." The author's conservative attitude toward the efficacy of the therapy is based upon his belief that "no patient can be cured of pernicious anemia." All known measures are transitory in effect. Remissions have been known to take place with or without medication, transfusion or the combination of both. "Systematic treatment under the mercury vapor lamp is certainly harmless (sic) and should be tried."

This book is an authoritative discussion of the subject and has presented the facts in a succinct and comprehensive manner. Its conservative attitude should appeal to all students and clinicians seeking a more detailed interpretation of the subject.

VERLAUF DER WICHTIGSTEN KNOCHEN- UND GELENKERKRANKUNGEN IM RÖENTGENBILDE. Eine Anschauliche Prognostik. By *Privatdozent Dr. med. Victor Hoffman.* Oberart der Chirurgischen Universitätaklinick im Augustu-Hospital zu Köln. With German and English text. Pp. 264 in 156 series and 584 illustrations. Paper. Price, R.M. 66. Berlin: Julius Springer. 1931.

The present volume is a notable departure from the average publication in that it contains an English text which parallels with the original, German. It was introduced by the author for the purpose of mutually benefiting the scientific workers of both nationalities. The material has been so arranged as to demonstrate the most salient factors in bone and joint diseases by means of a rich display of x-ray photographs. They portray in group formation the various stages and courses of disease. The logical sequence of this arrangement as well as the splendid photography will be mutually appreciated by physician, student and workers in this specialized field. It helps to establish the nature and course of the disease and to interpret any abnormal deviations from its normal state.

Incorporated in this book are study interpretations of acute inflammatory changes resulting from hematogenous infections from dental caries, trauma, osteomyelitis, acute and non-specific arthritis. Individual chapters are devoted to bone changes associated with chronic inflammation of a specific nature, i. e., tuberculosis and congenital syphilis; to tumors; to growths associated with nutritional disturbances; to chronic non-specific joint diseases; injuries; bone transplantation and joint formation.

It has been the author's aim to submit through the medium of these plates, "actual experience that could be used in practice. At the present time there exists in the medical profession an increasing tendency to overlook the essential fact—that is, the healing power of nature; taking instead, small unimportant things into account and failing to make either the correct diagnosis or treatment. If the anatomical examination method, on which this book is based, is sometimes looked upon as out of date in some of our clinics, this is really only justified when related to a one-sided description form. From an anatomical picture—more particularly from a series, the development of a process in the living subject may make the entire picture better under-

stood. We recognize the type of pathological process by its outline or form, and by following it throughout its various stages, we can identify the direction of its progress. In the same way we are able, with our ever-increasing knowledge, to verify more detail, and by practice we learn to visualize the body and by observing one aspect, to follow its further course."

This work is one of the finest examples of x-ray photography published in recent times. The publishers are to be highly complimented for the meticulous artistry that went into the creation of this book.

THE AUTONOMIC NERVOUS SYSTEM. By *Albert Kurtz,* Ph.D., M.D., Professor of Anatomy, in St. Louis University School of Medicine. Cloth. Price, $7.00 net. Pp. 576 with 70 illustrations. Philadelphia: Lea & Febiger. 1929.

The past decade has witnessed an increasing interest in the action of the autonomic nervous system by both the medical profession and the research worker in the laboratory. Voluminous data has gradually been accumulated which has demanded critical analysis by one oriented in the subject. The present work is the completion of such a task. According to the author, "an attempt has been made in the present volume, on the basis of the older and more recent studies, to describe the autonomic nervous system briefly, but adequately, in relation to the organs and tissues innervated through it and in relation to the cerebrospinal nervous system, to point out its developments and its relationship to the cerebrospinal nervous system, and to set forth the more important pathological and clinical data bearing on the functional relationship of this division of the nervous system in disease."

An exhaustive amount of information has been sifted through for the purpose of only permitting that which is authentic and pertient for this work. In spite of this attitude the material introduced is so rich in the quality of its information that it is definitely encyclopedic in character. The bibliography appended to the end of the book offers one of the most scholarly compilations for collateral reading to be found in any recent book on the subject. It is arranged in alphabetical order and follows the subject according to chapter.

In general the subject matter is presented in a concise manner and includes a summary of all our knowledge to date concerning the autonomic nervous system. The autonomic innervation of all the systems of organs of the body is first considered in an orderly sequence. Illustrations, many of which are photographs of actual dissections, aid the reader in his understanding of this heretofore most difficult branch of anatomy. An interesting outline of the pathology follows. The subject of visceral sensitivity and referred pain is fully considered from every angle. The surgery of the autonomic nervous system is taken up in detail, and the procedures of periarterial sympathectomy and sympathetic ganglionectomy and ramisection are described, together with the disease conditions that indicate their use.

This volume should make as particular an appeal to the physical therapist and radiologist in the light of the recognized relationship that exists between their therapy and its action by means of the autonomic nervous system as it no doubt will to clinician, surgeon, anatomist and physiologist. It is also recommended to the profession at large as a valuable reference book on the subject.

INTERNATIONAL ABSTRACTS

Werden Und Wert Des Su-Da-Bades. (Genesis and value of the Su-Da-Bath). Olpp.

Müchn. med. Woch., **76:**1838 (Nov.) 1929.

Olpp discusses the indications and results of the subaqueous bath, inaugurated by the lecturer, Brosch (Vienna). The treatment consists in an abundant flushing of the patient's bowels with large quantities of fluid (25 liters), while he is sitting in the warm bath, and is done by a special contrivance called enterocleaner. Olpp has made several technical improvements on the enterocleaner in order to prevent faecal particles from penetrating into the bath itself or into the vagina, which is obtained by a wide bicycle saddle with pneumatic india rubber cushion. Olpp uses subaqueous bath not only in various forms of constipation and inflammatory diseases of colon, but also in colibacilli infection of the urinary tract and metabolic affections. The author has among others obtained very good results in a boy with ascending and transverse megacolon. At the first lavage enormous faecal amounts were removed; after 15 lavages the bowels which were until then sluggish, functioned normally again. With the subaqueous intestinal baths Olpp has washed away many threadworms and hookworms, also ascarides and tape words, the latter being voided far easier after administration of male fern. Olpp uses as standard solution Kamillosan or green soap in normal saline solution; besides, if necessary, Yatren, tincture of Belladonna, potassium permanganate or magnesium sulphate can be added. Olpp further succeeded in expelling ureteral calculi with the aid of subaqueous intestinal baths, which result is to be ascribed to its combined action (increase of diuresis, antispasmodic and reflex processes).

Close medical supervision, thorough acquaintance with the routine technique, observation of the contraindications (cardiovascular deficiency, arteriosclerosis, nephritis and nephroses, hypertension, diabetes mellitus, hyperthyroidism, intestinal diseases with perforation possibilities) are necessary in order to keep this procedure as advocated by Olpp from being condemned.

Die Heliotherapie Der Spondylitis Tuberculosa. (Heliotherapy of tuberculous spondylitis). Rollier.

Zeitschr. f. orthop. Chir., **51:**220, 1929.

Rollier demanded fractional whole sun baths for his patients. Sun bath treatment besides other values also have decongestive effects. This end is attained by beginning and closing the irradiation at the inferior limbs, irrespective of the seat of the focus to be treated. Thus, congestive actions on the inner organs are avoided. Sun bath treatment should begin with short fractional doses in order to permit gradual adjustment and produce pigmentation, indispensable for the defensive functions of the skin, without causing the appearance of erythema solare. As in spondylitis, immobilization in horizontal posture is absolutely necessary. The question of the type of bed is of importance. Experience has led to the use of a long-legged iron bed, which allows the sun beams to penetrate over the wall of the porch. A hard horse-hair mattress is necessary, because a soft one becomes easily depressed in spots and favors bad positions. Cases of spondylitis without marked gibbosity are placed on the mattress without cushion. In case of advanced loss of weight and bone atrophy, however, cushions filled with millet chaff are extended over the mattress in order to obtain a normal situation of the spine. Another cushion holds the scapulae and head. For children and fidgety patients the same disposition is supplemented by a fixation girth over the thorax. It being then in turn fastened to the mattress by several lengths, the patient is thus quitely immobilized in recumbent position. When spondylitis is complicated by gibbosity, Rollier seeks to influence the latter alone by the body weight progressively. First a millet chaff cushion and afterwards a sand cushion, little by little they are enlarged by filling-up, and placed under the kyphosis. When pain has disappeared, which as a rule occurs some weeks after the onset of treatment, the patient is also brought in prone position during a part of the sun bath, and the diseased area of the spine is exposed to the sun. Under the thorax is placed a wedge-shaped bolster, which reinforces the lordosis of the spine and acts upon the kyphosis of the dorsal and lumbar vertebrae as a corrective. Heliotherapy in conjunction with immobilization in horizonal position (recumbent and prone positions) ought to be continued 'till roentgenography shows the focus to be cured. This result is mostly obtained from 1 to 2 years after treatment has begun. In spondylitis and phenomena of paralysis, Rollier employs traction measures (in cervical spondylitis an extension contrivance by means of a head sling, the traction attacking the occiput; in case of foci situated lower down, pelvic extension by means of a rubber towel girding the hip). The results obtained by Rollier in his clinic (Leysin in Switzerland) are excellent.

Hydrotherapie. (Hydrotherapeutics). G. Hauffe.

Mediz. Welt, **3:50:**1801-1804 (Dec.) 1929.

There is hardly anything better for diseases of the cardiovascular system than partial water baths. Their application has the essential advantage of allowing them to be prepared in the poorest housekeeping, even without special bath tubs and with only a small amount of water. For an arm bath

which as a rule is the first to be taken, a flat piece, for instance a fish kitchen pot, will do, for a sitz bath any flat, troughshaped vessel. Ten liters of boiling water are required. One begins with a water temperature of about 37 degrees C. and increases the heat by gradual addition of hot water. Thus in about 10 to 15 minutes a water temperature of about 42 to 45 degrees C. is reached. With this the patient is gradually getting into a sweat, but without experiencing thereby respiratory or cardiac troubles as happens mostly in hot air and vapor baths or packs rightly rejected by the patients. On the contrary they soon perceive a relief in that the blood previously stemmed in the heart and pulmonary region is derived to the periphery of the organ under treatment and now otherwise distributed in the system; shortness of breath and throbbing of the heart subside. Partial baths are exceedingly beneficial in patients with hypertension and in seizures of stenocardia and tachycardia.

Bestrahlungsapparat Zur Heilung Von Heuschnupfen Und Katarrhen Der Oberen Luftwege. (Radiation apparatus for cure of hay fever and catarrhs of the upper air passages). Alfred Salmony.

Med. Welt, **3**:762 (June) 1929.

After analyzing the routine methods of treating hay fever (diminution of the irritability of the vegetative nervous system by adrenalin, ephedrin, desensibilization, according to Storm Van Leuwen, by extracts from various herbs and blossoms) the author points out a new form of treatment, viz., with the ultrarayor apparatus. It is an electrophysical motion apparatus for nose, ear and mouth and consists of a movable fork containing two apertures into which two glass tubules can be screwed. For common "coryza" blue light radiation by small bulbs of cobalt glass is used on account of its bactericidal effect, while small bulbs of ultraviolet permeable glass are used for the ultraviolet irradiation management of hay fever. Electric tension is produced by a small dry couple. Exposure time depends on the gravity of the case. On an average, irradiation with blue bulbs should last for ten and, subsequently for 5 minutes with the white bulb. It is advisable as a prophylactic measure to irradiate before the beginning of hay fever. It is of importance that the incandescent lamps should be introduced into the nasal ducts correctly, i.e., half horizontally to the back.

Carcinoma of the Rectum Treated by Radium. Harry H. Bowing, M.D., Robert E. Fricke, M.D., and Louis A. Buie, M.D.

The Radiological Review, **53** *(March) 1931.*

By radiologic treatment of carcinoma of the rectum, with the careful study of each case with cooperation of clinician, surgeon and proctologist, excellent results can be accomplished. Biopsy should always be made when possible. It is not essential to diagnosis but grading of the lesion is important to both surgeon and radiologist. The treatment factors are determined by the situation, size and character of the rectal growth as well as the general condition of the patient. A standardized plan of treatment hence is not feasible. The risk of treatment by radium is slight. Conclusions should not be drawn, of course, from this one case; it is described mainly as an attempt to portray the difficulties and complications which occur in this type of malignancy.

Orthopedic Aspects of Chronic Rheumatism or Arthritis. Robert Bayley Osgood.

Journal of the American Medical Association, 95:992 (October 4) 1930.

Prevention of deformity and maintenance of joint motion.—If a joint threatens to become permanently stiff in spite of treatment, the optimum functional positions of ankylosis must be kept constantly in mind.

Local treatment of joints.—The primary object of local treatment of the affected joints should be to increase their blood supply. Heat in its various forms of application, massage, and voluntary exercise, stopping short, of course, of irritation of the joints, in other words, intelligent physical therapy, often attended by its useful handmaiden occupational therapy, relieves pain and improves function.—Abs. *Internat. Med. Digest,* 1:18 (Jan.) 1931.

Radioaktive Konstante Mikrostrahler In Der Balneologischen Praxis. (Radioactive constant microradiators in balneological practice). Salz.

Med. Klin., **25:51**:1899 (Dec.) 1929.

The principle of microradiators rests on the fact that small doses of radioactive substances have no destructive effect on the cytoplasm and nuclear substance, but increase the viability of the tissue by stimulation, thus, owing to this biologic action, promoting the cell metabolism associated with a very pregnant analgesic effect. The most conspicuous representative of these microradiators is the radium compress. Such a one is brought into trade by the Joachimsthal State works (Tchecoslovakia) under the name of radiumchema. The alpha-rays and part of the beta rays are absorbed in these compresses by the stuffing substance and the envelope so they need not therapeutically be taken account of, whereas the harder portion of the beta rays and the gamma rays take effect best qualified as "activation of tissue". Consequently an analgesic effect on the one hand and a stimulating effect on the other hand in the direction of an acceleration of the oxydative processes in the tissues results by the use of radium compresses. This activation can manifest itself only in a therapeutically positive sense, as the threshold value of a dosage sufficient for serious irritation of the tissues is not yet reached. The radium compresses have served the author best in spells of megrim as sedative and analgesic, in trigeminal neuralgias, wry neck, in chronic cases of muscular and joint rheumatis, and also in dermatitides associated with severe itching. The employment is very simple, the compress is put on the area to be treated and fastened by a bandage so as to be able also to act by night.

Der Gegenwaertige Stand Der Strahlenbehandlung. (The actual state of radiotherapy). H. Holthusen.

Dtsche. med. Woch., **55:**1491 (Sept.) 1929.

The general experiences gathered on the effects of radiotherapy in the several classes of tumors and locations are of fundamental importance for decision as to whether radiotherapy is to be applied at all. It should not be forgotten that there may be other methods of treatment, which empirically offer better prospects of success. That all operable cases should be submitted to operation is no longer maintainable in the presence of existing knowledge on the value of radiotherapy. There are cancers which had better be irradiated, though operation offer no difficulties. On the other hand, there are tumors in which the advice of radiotherapy cannot be answered for, if any chance of operative cure still exists. Very often the chances of cure become best by combining operation with radiotherapy. This combination may take place in various manners. It may occur, that the primary tumor offers a favorable point of attack to the rays, whereas it is more expedient to combat lymph node metastases operatively (associated therapeutics). In other cases it may become necessary that appliance of rays be preceded by an operation, making access possible for the local treatment of malignant tissue (radiosurgery), or that larger tumor masses be removed by thermoelectricity (conjugate therapy). Postoperative radiotherapy is especially well known as it is supposed to reduce the danger of recurrence. Pre-operative irradiation is advisable if it effects a decrease in size of the tumor, thus facilitating or creating the technical conditions for operation.

It is stated, especially, that cancers of the face yield to larger doses of radiotherapy. With roentgen rays and radium (cast therapy) very good results have been obtained here. In cancer of the tongue, "needling" with radium or radon gives the best results. Holthusen calls attention to the fact that radiotherapy is only of value for primary tumors, while for treatment of lymph node tumors operative procedure remains the method of choice. Operation is more and more limited in uterus carcinoma in favor of radiotherapy. Only adenocarcinomata are radio-resistant, yet they form only a small percentage of the tumors of the cervix. Operative chances are more favorable in cancers of the body of uterus. As to cancers of the breast, several researchers (among them also Wintz) have already obtained good results by x-raying; nevertheless, since it is well located and locally circumscribed it falls within the domain of operation. As for the other types, Wintz does not object to excising the tumor when it is shrunken by irradiation. Post-operative irradiation in cancers of the breast is the most frequent use of radiotherapy.

Treatment of rectum cancers sets an example of "conjugate therapy." The establishment of an artificial anus as preliminary step to intense local irradiation of the morbid focus represents such a preparatory measure. Furthermore, procedures have been devised to facilitate the local treatment of the primary tumor and regionary lymph nodes with radium. In cancers of the digestive tube, inclusive of those of the gullet, even the latest technique has not been able to change the results.

Dosierung Und Technik Dermatologischer Roentgentherapie. (Dosage and technics of dermatological roentgen ray therapy). G. H. Schneider.

Strahlentherapie, **33:**181 (July) 1929.

For dermatological dosage a thrice repeated single dose of ⅛ of the skin unit dose, or 12.5 per cent, has been found efficient in treatment of eczema and psoriasis. Rarely the single, unfractioned administration of ½ skin unit dose or 50 per cent will be sufficient. Thus Schneider succeeded in ten cases of diffuse, strongly itching eczema to completely regress by a unique irradiation of 50 per cent of the skin unit dose. Care of skin is of great importance in roentgen ray irradiation. For inunction of the irradiated places, every patient submitted to deep irradiation gets a roentgen salve from the author, composed as follows:

Sal sedativ. Hombergii	1 per cent
Ol. oliv.	36 per cent
Cer. alb.	4,2 per cent
Adipocer. cet.	4,8 per cent
Cosmolin	38 per cent
Aq. dest.	15 per cent

The combination of irradiation with the very durable, fatty and supple skin ointment has been found of value in irradiations of the skin. Roentgen therapy is only indicated for old, chronic efflorescences in cases rebellious to medicinal treatment, particularly when even tar fails to be effective.

Die Roentgenbehandlung Der Chronischen Paronychie. (Roentgen ray treatment of chronic paronychia). Richard Rohrbach.

Strahlenther., **35:1:**136 (Jan.) 1930.

Paronychia is most frequently met with in certain professions of quite definite description. Confectioners' apprentices, decorative painters and mechanicians are to be classed in this category. Without adequate treatment this affection may last for months and years. Surgical treatment is ineffective, because there is no liquid pus and an incision would only encounter granulomatous tissue. Antiseptic fluids penetrate into the depth of the nail fold by moist dressings just as little as do salves. Roentgen ray treatment proved however to be very efficient, the patients could be released from their complaints and finger deformities in a very short time. The author gave 12 irradiations with 2 mm Al. filters (dosage according to Hans Meyer by means of Sabouraud-Noiré tabloids) and repeated this irradiation once again after 6 weeks, in case of recurrences after from 3 to 6 months twice again. The surroundings were closely covered so that only the terminal phalanges of the fingers were exposed to rays, the joint however received no rays. The result was always very favorable.

Die Behandlung Der Gonorrhoischen Gelenkentzuendung. (Treatment of gonorrhoic arthritis). Wilhelm Baetzner.

Med. Welt., **4:8**:250-252 (Feb.) 1930.

The hyperemic treatment suggested by Bier is for the practitioner the method of choice. Once the diagnosis is established, this treatment should be commenced immediately. Hyperemia is obtained by a thin india-rubber bandage 6 cm. wide which is applied above the diseased joint. In diseases of cervical vertebrae and of the mandibular joint hyperemizing of the head is applied. It is carried out by means of a band of cotton gum (garter) 2 or 3 cm. wide provided on the one side with ears, on the other with hooklets. A piece of felt about a thumb's breadth is put as a support on both sides medial to the sternocleidomastoideus on the jugular vein and in protection of the larynx. The stasis is maintained every day for 22 hours, then the bandage is taken off for two hours to allow the edema due to stasis to flow off. The limbs are given a raised position or suspended by a band tractor or the edema may also be lightly massaged away. The effect of the stasis depends on the right degree of stasis: it should be possible to feel the pulse in undiminished strength on the limb submitted to stasis, the veins should be engorged, the limb in stasis a deep red and hot to the feel, and the patient have a feeling of well-being. The patient should be observed for some time and the degree of tightening the bandage varied by stretching or loosening. Cold stasis characterized by the limb appearing pale and anemic and by the occurrence of painful pricking is no stasis, but only a tying up, warm stasis is, true, effective, but far from being so to the same extent as the really hot stasis. But it is just this which is the best method of treatment for the most severe forms. The first effect of the stasis is the almost instantaneous alleviation of pain, it renders also the long missed sleep and is the best hypnotic. The relief of pain, however, also immediately enables active movements, this fact being looked on as the most important curative effect of stasis. By exercises undertaken as soon as possible the reflex muscular rigidity is removed and the menacing ankylosis efficiently prevented. Also chronic gonorrhoea of the joint is able to derive benefit from hyperemia treatment, which prevents complete ankylosis. However in such cases it seems to be more difficult to obtain hot stasis. Hyperemia treatment is then replaced by hot air administered by the hot air cabinet of Bier, by which dry heat of from 100 to 120 to 150 degrees C. is reached. Hot air treatment is also to be applied when it is impossible to employ stasis, for instance on the hip and shoulder. For this purpose on the hip joint is applied an extension bandage, and the shoulder put on an abduction splint.

Clearing up of the new process is to be followed by an after-treatment, as baths, hot air, diathermy, active and passive movements, gymnastic exercises, and, if contractures have formed, by spring and india rubber traction carried out until the best possible function is attained.

Ueber Hemiplegien Und Ihre Behandlung. (On hemiplegias and their treatment). O. Veraguth.

Schweiz. med. Wochschr., **60:1**:9-13 (June) 1930.

The treatment of post-apoplectic hemorrhage is essentially of physico-therapeutic order. The first aim of the treatment of motor troubles is to avoid or diminish contractures, the second one to recuperate active motility. Prevention of contractures ought to be begun as soon as possible. A few days following the apoplectic fit the endangered limb should be moved constantly in various positions, the arm repeatedly, gently abducted, but to the maximum extent, the hands extended in the same manner, the lower limb carefully maintained alternately extended or flexed in hip, knee and ankle joints for half an hour. Later on, when the patient has regained some motility, passive movements should be continued in tepid bath. It cannot be claimed that it will always be possible to avoid contractures entirely to a certainty. It is only a question of greater or smaller success, but even small differences in motility can be of greatest importance for the patient. The following rule applies to the active exercises: little at a time, but often something. When the contractures are not or no longer very hindering, playing with three small glass-globes held in the hand and caused to shift their mutual position, proves useful. In order to overcome the proximal spastic paresis of the arm, spots on the patient's own body ought to be indicated as marks which the hand should endeavor to approach or reach, say the mouth, the opposite shoulder, the other ear, the space behind or above the head. As regards walking it is necessary to analyze the normal gait, show it to the patient in its single phase that he may imitate it, and let him see what differs from normal in his case. Once the patient is able to walk properly on level ground he should be made to overcome obstacles, say a tilted-up book or a footstool. Then one proceeds to exercises in going upstairs. Intelligent patients can be explained the nervous mechanism underlying the disturbance, in order to thus enhance their interest in the exercises.

It is wrong to use petrissage in hemiplegics, because any stronger stimulus conveyed to the cells of the anterior horn cannot but increase the contractures; only slight effleurage for furthering the blood circulation of the skin and as a sedative is permissible. Faradic stimulation of the hemiplegic motility trouble meets the author's disapproval, as thereby stimuli are emitted from the periphery into the motor end paths via sensory paths of conduction and contracture of the muscles thus suffer further impairment.